

Get a new home without moving Page 63

Electric, Smokeless
**INDOOR BARBECUE
CART** Page 134

Popular Mechanics

FEB. 1972
50 CENTS

New water-cooled (!) bike:
SUZUKI'S 750

SAVE \$\$:

The simple way to do ignition
timing yourself Page 116

Do-it-yourself cassette
recorder repairs Page 110

Appliances you can fix:
electric knives, toasters,
washing machines

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flies on CO₂
Page 144

New
outboards:
more power,
less pollution
Page 98

Easy-to-build
COLONIAL DRY SINK
makes you look
like a real craftsman
Page 138



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things like "mag wheels," "zoom" gears, traction bars and a wild cam.

Two weeks after he got the car he went "halves" with a friend on a whole case of Champion Spark Plugs.

"All the big pros race with Champions," said Fred. And zoomed off into the sunset.



Toledo, Ohio 43601

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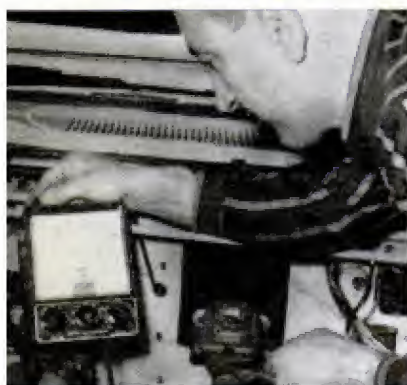
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ON THE COVER: Photo by David Gooley

New water-cooled (!) bike—Suzuki's 750-cc, three-cylinder two-stroker

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LETTERS TO THE EDITOR

Keep the power at home

How to have power when there is none (page 156, Dec. PM) is very timely and informative, but there's a very misleading statement in the first paragraph, page 158, regarding a transfer switch preventing power from escaping back into the utility line and "raising some poor workman's hair." Apparently the author is not fully aware of the extreme danger to an unsuspecting lineman working on "dead" power lines. The 115/230-volt output of the home generator is stepped up to 4160, 7200 or even higher voltages as the current passes through the utility's distribution transformer.

Alternator users should be very certain that any connection to the power company is open before feeding standby power into house circuits.

SOUTH WHITLEY, IND. MEREDITH SLATER
SUPT., MUNICIPAL UTILITIES

We did say that a transfer switch is a must (with "must" in italics)—but we'll repeat your lengthier warning in the interest of safety.

Fantastic race cars

Your article about radio-controlled racing cars is great (*Now you can be a race driver—at any age*, page 69, Dec. PM). Those little cars are truly fantastic!

SHREVEPORT, LA. JOE CALDWELL

Twice 300

In the July *Letters* column, John G. Lattire boasts 300 copies of PM. As a boy, I bought my first copy in September 1913 for 15 cents. I now have twice as many as 300, and most of them bound in my library.

OKLAHOMA STATE UNIV.
STILLWATER HASKELL PRUETT, PhD
PROFESSOR

Nonessential machines, spoiled riders

I have enjoyed your magazine for a number of years, but recently, especially in the October and November issues, you have plugged and promoted minibikes and snowmobiles. I am not in favor of either of these vehicles as family sport or recreation. They are noisy! They despoil the wilderness! They frighten wild ani-

(Please turn to page 8)

Have you seen this coupon before?

It has helped
to start
many men
and women
on the road to
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LETTERS

(Continued from page 6)

mals! They are unnecessary! And more often than not, the people who herd them around are rude and thoughtless and care little for others or their surroundings.

As cheap transportation, cycles can be forgiven. As emergency vehicles, snowmobiles can be forgiven. But for sport—no. They are dangerous to the many young, spoiled riders who have duped their parents into buying these nonessential machines (except, of course, to the manufacturer who is reaping his harvest).

SALINAS, CALIF.

GEORGE RAGSDALE

Shingle builder

I recently completed the *Saucy Shingle* (page 144, March '65 PM), which was featured in project book H102. It was built with few changes—the most noticeable being the addition of a hinged-cover



storage compartment forward of the steering wheel. Cost was just under \$35, not including gear. My Shingle looks great painted bright yellow, and with a 20-hp Mercury, it really flies!

DELAND, FLA.

NOBLE BIELBY

Some are ridiculous

I liked '72 *Cars: Why You Should Buy Now* (page 114, Oct. PM). I think this is how Americans think about safety. But I feel some of the ideas are ridiculous and some are good.

ELROY, ARIZ.

HARRY BUCHANAN

Wanted: noise penetrator

I'd like to see incorporated in every motor vehicle a sensing device to warn its driver of a police siren, fire siren, or train whistle.

With manufacturers making cars quite soundproof and with stereo players and

(Please turn to page 10)

**I can buy
passenger car tires
for less than truck
tires and get the same
mileage out of them.**

**I can buy truck
tires for less than
car tires and get
more mileage
out of them.**



Do you know which man is right?

To a lot of people, "truck tire" sounds expensive, and because passenger tires will fit their pickups or vans, they reason they can save money with them.

Did you know you can buy a real truck tire—the Firestone Transport—with a 6-ply rating, for about \$8 to \$10 less than a comparable size original equipment passenger car tire? And get longer mileage in truck service with the truck tire?

Why? Because the Transport is designed for truck use, with Shock-Fortified nylon cord body plies and heavier construction to handle the road hazards with a tread made from a

specialty compounded Sup-R-Tuf® long mileage rubber, and with reinforced beads and sidewalls.

See your Firestone Dealer or Store. Ask about the truck tire that costs less and lasts longer than a comparable passenger car tire, in truck service, the Firestone Transport. And yes, it also comes in whitewalls.

Transport 80



Firestone

Transport®

LETTERS

(Continued from page 8)

radios blasting away, it is next to impossible for outside noise to penetrate the vehicle and its dense operator. I've had many a harrowing experience with such a deaf and blind driver—as has many an emergency vehicle, I'm sure, trying to expedite their services through traffic.

COUNTY SHERIFF DEPT. W. W. HENRICK
LAGRANGE, IND. CHIEF DEPUTY

Very accurate measurements

Thank you very much for publishing *A Bumper-Pool Table You Can Build* (page 146, Jan. '70 PM). I am 13 years



old and I am very pleased with the measurements that were very accurate. The table brings me a great deal of enjoyment.
NEW YORK IRA FOX

Vicious and vindictive

The Pollution Fighters' Newsletter (page 42, Dec. PM) is vicious, vindictive and anti-American. It should not be allowed to pollute the pages of your magazine.

The author threatens the use of an old law which dangles monetary reward in front of persons with a weakness for easy money so as to catch and punish their "greedy" neighbors. Encouraging neighbors to spy on one another, children to spy on their parents, etc., is a method of terrorism that has been developed and used extensively in every communist, fascist and other totalitarian country. Until recently it had not been the practice in the United States.

In recent years a number of instances have been reported of persons having been caught deliberately pouring jars of concentrated poison into lakes and streams. Why would a man do this? The obvious reason is that he wants to cause the shores to be lined with dead fish and birds so

they can literally raise a stink about pollution. Undoubtedly there have been cases of this where the miscreant was not caught but it was generally assumed that nearby residents or industries polluted the water. Framing of innocent persons is a distinct possibility here.

The most effective and cheapest way to do something about pollution is for citizens to work voluntarily on the problems on a local basis.

BURLINGTON, W. VA. LEO D. PATTERSON

Home for a pet

Here's a picture of the doghouse I built recently from the plans in *Insulated Home for Your Dog* (page 172, April '58 PM). I ordered the plans (No. X232) from



your *Plans, Publications, Projects* catalog.
LEESBURG, VA. BOB F. HENSLEY

Anyone else who has a dog without a home can buy the plans for 45 cents from *Popular Mechanics*, Dept. JL, 224 West 57th St., New York, N.Y. 10019.

Needs lightweight chain

Six months ago I purchased a 10-speed bicycle. So far, I've had two robbery attempts on it. I bought a three-foot, half-inch chain with heavy-duty lock. Together they weigh seven pounds. Since my bicycle is lightweight, this chain destroys the purpose. Do you know of any case-hardened and cutter-resistant lightweight chain?

MONTCLAIR, N.J.

SCOTT POPPELE

Offhand, no, though we do know about other heavy ones. Maybe our readers can help. (And we'll file this question away for best-selling author Eugene Sloane who'll be solving bicycle problems every month (beginning next month) in PM's new Bike Shop column.) ★★★

Read what two of America's foremost car experts say about

NEW NRI HOME TRAINING IN AUTOMOTIVE MECHANICS

After more than two years in preparation, NRI presents what are considered to be the most up-to-date, comprehensive and easy-to-learn home training programs in Automotive Mechanics. Not content with simply paralleling what others offer, NRI commissioned one of America's best-known automotive writers* to prepare the training material . . . then asked two of the country's foremost car experts to act as consultants and "critics" of the courses *before* we presented them to the public.

Here is what "Bill" France has to say:

"I'm very pleased to find that someone has finally developed a home training program for mechanics that's right up with the times. The new NRI Master Automotive Technician course for mechanics is amazingly complete and seems to cover all major aspects of today's complex cars. Certainly, a man with an NRI diploma in automotive mechanics is well on his way to a solid career in a field where his knowledge is in demand. The texts are great, and the equipment you get is top-quality — and essential. This program promises to make real mechanics out of men seeking a solid profession."

Tom McCahill is equally enthusiastic:

"This baldheaded bearcat has been worrying for years about the condition of our automotive repair industry, so it's a great relief to see a highly qualified school like NRI come up with home training that should do much to help ambitious guys become top mechanics. It either takes a lot of years of dirty hands or a comprehensive training program to come to grips with car repair and know what you're doing. NRI has done it. I particularly like the way the use of essential equipment is worked into 'bite-sized' lesson texts. After over a quarter of a century in this business, I'm beginning to have some hope about finding good mechanics again — I'll just look for an NRI diploma on the repair shop wall."

*William H. Crouse, author of NRI mechanics training, has written nearly two dozen outstanding books on automotive subjects, and has been Editor of Technical Education Books for McGraw-Hill Book Co., including The McGraw-Hill Automotive Mechanics Series.



NRI'S TWO AUTOMOTIVE CONSULTANTS: Tom McCahill, America's foremost automotive editor/critic, with William H. G. France, President of NASCAR and the International Speedway Corp., at Mr. France's famous Speedway.

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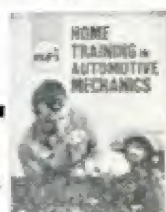
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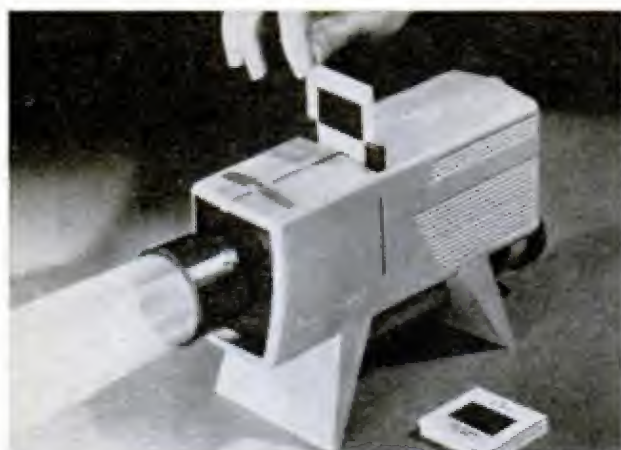
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ANYTHING YOU SPOT through these 7x50 binoculars can be captured on film just as you see it merely by pressing a button. A built-in half-frame 35-mm camera provides equivalent of a 231-mm telephoto lens. A motorized drive makes up to 72 shots on 36-exposure film as fast as you press the trigger—handy for nature photographers and sports fans. Speeds are 1/60th to 1/250th. \$325, Braun North America, 55 Cambridge Pkwy., Cambridge, Mass.



KIT-BUILT CAMERA for low-cost snap-shooting has a simple plastic housing that snaps onto a standard 126-size film cartridge. Bubble-packed parts (far left) include lens, shutter and a film-advance knob that engages film's winder sprocket. The kit, expected to sell for not much more than the price of the film itself, is made by Plastics Development Corp., 9810 Ashton Ave., Philadelphia, Pa. 19114.



LOW-COST TIME-LAPSE ATTACHMENT fits most Super-8, 8-mm and 16-mm movie cameras, enabling you to make "speeded-up" films of eggs hatching, flowers blooming, sunsets, and so forth. Exposure intervals range from one a second to one every five minutes. Thus action sequences spanning days can be compressed into several minutes of viewing time. Time-Trigger can be used with cameras having remote electrical single-frame control or, by using an accessory, with those having cable-release controls. Timer is \$49.50; the accessory, \$59.50. American General Products, 1000 1st Ave. S., Seattle, Wash.

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"What started as a hobby, now pays me \$10 an hour"

Yes, many MUI graduates make better than \$10 an hour turning old wornout furniture into bright new decorator pieces! Stack it up against what you're doing now! Are you making \$150 a week? \$200? \$250? Do you put in long hours of dull work, with small raises? Is that the way you want to spend the rest of your life? Just imagine, you can make \$150, \$200, \$250 upholstery just one chair or sofa these days! And if you're the kind of person who likes to work and earn, you can sometimes finish a job like this in a day. That's pay, ... and it beats what most college graduates make!

AS YOU LEARN, YOU JUST SLIP INTO THE IMMENSE FLOW OF UPHOLSTERY WORK! Think of all there is! ... Sofas, lounging chairs finished in beautiful fabrics, which MUI tells you how to get at the right price — even leather and all the new vinyls. And then you have built-ins and breakfast nooks, boats, trailers and all the millions of automobiles in America. Yes, you learn all this and more! When we finish teaching you, (in your own home in your spare time) and when you get our California state approved diploma, you know this business ... as a real professional! You will then have one of the most fantastic moneymaking skills in America built into your head and hands! No one can ever take this skill away from you ... and no one can ever fire you, because you're the boss of a business that you can take with you ... You can make big money from then on ... any time, anyplace you want to put out your shingle!

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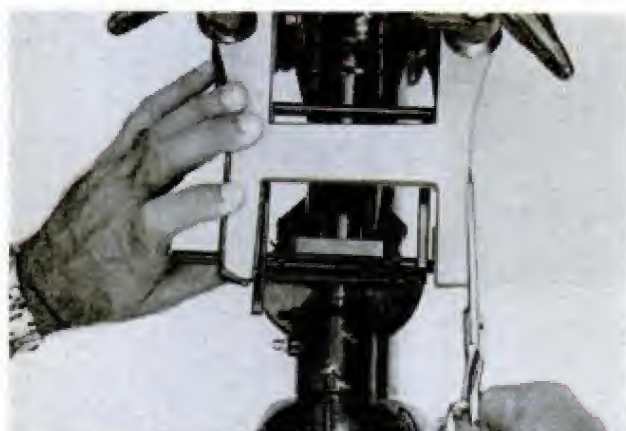
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By BOB STEARNS

Carpet your outboard motor



SKETCH shape of bracket on cardboard; trim to size



CUT rough-surface outdoor carpet to template shape

SMALL SPARE ENGINES for trolling or getting you home are becoming more popular. You may want to mount one of these 2 to 20-hp units—which use clamp brackets—alongside your standard kicker but find no protective pad on the transom. Teeth on your outboard bracket, designed to grip a wooden transom, can bite into fiberglass and the abrasions may allow dry rot to start in inner wood stiffeners. Such

ridges will also chew up an aluminum transom.

So, buy a dollar's worth of rough-textured synthetic fiber carpet and spend another dollar for contact cement and a pure bristle brush—some cement solvents dissolve nylon. Paint both cut-to-fit carpet and brackets with cement and let dry before joining. New pad grips even better when wet, but use safety chain. ★★★



APPLY contact cement to carpet and metal bracket



PASTE carpet discs to round screw clamps as well

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tubing to connect. Installation kit (left, above) includes hookup wire and all necessary sensor fittings. It can be used with any 12-volt negative or positive-ground electrical system. \$19.95, Lafayette Radio, 111 Jericho Turnpike, Syosset, N.Y. (Catalog No. 11R42033).



MINI-COMPRESSOR is small in size, but provides a powerful air supply for inflating tires and pneumatic jacks in an emergency or for blowing up rafts, air mattresses and beach balls used on camping or vacation trips. It operates on 12 volts d.c. and plugs into a

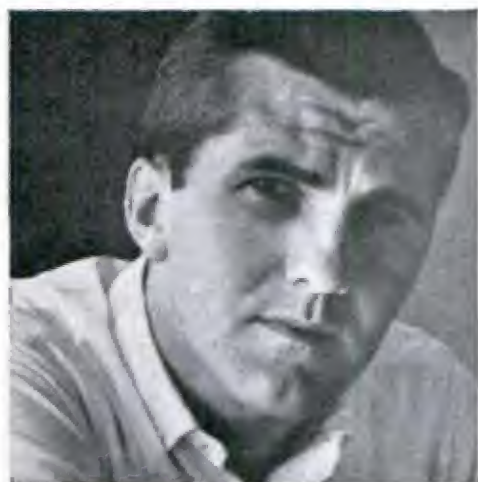


car's cigaret-lighter socket (left, above). Auto-Flator produces pressures up to 80 pounds p.s.i. and comes with 10-foot air hose. Interchangeable nozzles enable the hose to fit most inlet valves. \$29.95, W. R. Brown Corp., 2701 N. Normandy Ave., Chicago, Ill. 60635.



STRANDED MOTORISTS can indicate their need for help with this brightly colored sign that simply clips to the edge of a window. Made of plastic, it's painted a highly reflective fluorescent orange, folds up for easy storage in a glove compartment. The window sign is designed to eliminate the hazard of getting out of your car to raise the hood or tie a handkerchief to the antenna, said to produce many roadside injuries. It's \$2 from INH Corp., Box 2564, Milwaukee, Wis. 53214.

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Recently we mailed out a questionnaire to a group of our graduates, two years after they had received their ICS diplomas.

The main objective of this questionnaire was to determine if spare-time study had helped them get ahead faster.

- Those who answered the questionnaire reported that they were earning *almost \$1200 more* (median) than the day they'd received their diplomas.
- Over 18% said their annual pay had grown *\$2000 or more*.
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Here's your way to land a good job, to advance in your present job—or to find a very special new job in the business world. ICS training is practical, up-to-date, and very helpful in making your life pleasant, rewarding, secure.

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The electrical maintenance, repair, and building fields call for more and more trained electricians. Here is real security doing a job you like to do. ICS is famous for its training in electricity, step-by-step from basics to full professionalism.

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NEWS BRIEFS



Pilotless bomber

The Defense Department is experimenting with pilotless drone bombers at its White Sands, N. M., test grounds to find out if they can deliver bombs accurately to high-risk targets. The drones, carrying 500-pound bombs, are directed by remote control from safe areas.



Dye in the money

German bank officials in Darmstadt are transferring money in a new antiholdup bank van that carries a vat of dye in the top. If a bandit tries to snatch a strongbox connected to the container by hose, the dye is released, splashing colorfully over the banknotes to make them easily spotted as stolen money.



Driving by the digits

Today's instrument panel, with its sweep needle, revolving numbers and gas gauge may soon be replaced by a digital readout. Monsanto's version, made of 1500 diodes, tells the driver at a glance how many gallons are in the tank, his speed, number of miles driven and the status of his seatbelts and doors.



Radiator bathtub

Built for the Atomic Energy Commission, this huge tank is used to boil out clogged radiators of the large earthmoving equipment at the Nevada testing-grounds. The tub, built by the Barbee Co., can handle radiators up to 8 by 10 by 1½ feet. Gas burners, in heating the tank's water, generate enough energy to warm 10 average-size homes.

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POLLUTION FIGHTERS'

NEWSLETTER

By SUSAN MAZUR

THE FIRST "PLASTIC" BRIDGE using recycled plastic bottle-concrete, which collapsed Nov. 30 as it was nearing completion at Elgin, Ill., is expected to be rebuilt this spring, or as soon as the cause of the failure can be determined.

The 100-foot-long, 7-foot wide footbridge joining Walton Island in the Fox River with the city's civic center grounds is part of a project begun in 1969 by students of Larkin High School. After they restored the island, once a favored picnic spa, to its natural beauty, they joined the city to launch a "bridge the gap" fund drive. Next, 25,000 plastic bottles were collected from the public and local industry for the plastic-concrete mix: 30 percent sawdust-like plastic flakes; 70 percent concrete.

Experiments with the material indicate it weighs 10 percent less than an equal volume of concrete, with an insignificant loss of strength. Plastic-concrete also has a zero "slump" when wet, says Robert Layer, architect; i.e., the material won't distort because of gravity.

Such recycling is the best answer right now to the plastics disposal problem in America (3.5 billion tons are generated yearly), says Ralph Harding, Jr., executive vice-president, The Society of the Plastics Industry, Inc., since we've a shortage of landfill sites and inadequate incinerators and incinerator management.

ENZYMES IN DETERGENTS are safe, effective and nonpolluting, concludes the Committee on Enzyme Detergents of the National Academy of Sciences after a nine-month study requested by the Federal Food and Drug Administration and the Federal Trade Commission to determine whether there was any evidence that stain-removing enzyme materials posed a toxic hazard to users of enzyme detergents. The committee reports "it has been demonstrated the enzymes provide an additional benefit" in their ability to "remove many protein-based stains, and soil in general, more effectively than will detergent products without enzymes."

The study also established that when enzymes are discharged from washing machines into sewage treatment systems, they biodegrade within 24 hours. It suggested that in the absence of a solution to the current problem of the ecological effects of the phosphate builders, enzymes (as biodegradable agents) may assume a larger role in the laundering process.

"URGENCY OF PROTECTING THE OCEANS is one of the prime tasks that the Stockholm Conference is determined to meet, for marine pollution fits into the larger picture of the overall global environmental challenge—it is a part of the urgent need to defend the integrity of the biosphere." Maurice F. Strong, secretary-general of the United Nations Conference on the Human Environment so addressed delegates in Ottawa at the second session of the Intergovernmental Working Group to consider ways to save the seas. Jack Davis, Canadian Minister of the Environment, emphasized the need for unilateral action by coastal nations to prevent further marine pollution, pointing out that our marine environment comprised 70 percent of the biosphere.

The IWG discussed the following measures to preserve the oceans: priority research needs; identification of critical pollutants; developing systems to monitor the oceans; collection, retrieval and dissemination of information. Also examined were practical measures for control and abatement of pollution at the national regional and global levels. The first international conference is scheduled to begin June 5, 1972. (See PFN, page 76D, Oct. '71 PM.)

YOUR GOVERNMENT AND THE ENVIRONMENT is a book by Matthew Kerbec (Output Systems Corp., Dept. R, Box 2407, Arlington, Va. 22202) providing major federal-government environment information, such as appendices with names, addresses, and phone numbers of key congressional, federal and state personnel involved in pollution control; environmental budgets in nine federal agencies and the Environmental Protection Agency programs. Also included is a digest of air, water, radiation, pesticides and solid-waste pollution effects, technology and penalties; a glossary of terms used in pollution control and an index for fact-finding. Price is \$9.95.

DO YOU KNOW about some action being taken to fight pollution that we don't know about? In your community? On the job? Tell us about it. Write Environment Editor, *Popular Mechanics*, 224 West 57th St., New York, N.Y. 10019. ★ ★ ★

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SOLUTIONS FOR MECHANICAL HEADACHES

AUTOMOBILE CLINIC

BY MORT SCHULTZ

Not what it seems

I wonder how many of the thousands of 1970 Buick LeSabre and Wildcat owners realize it will cost them \$15 to replace a 25-cent rear stoplight bulb. From what I can see, the rear bumpers must be removed to reach the outboard tail lamps. Or am I wrong?—G.C. Dreizler, Utica, N.Y.

Yes sir—you're wrong. Although Buick hasn't made it overly conspicuous, there is a way of getting to the outboard tail lamps without removing the bumper. Raise the trunk lid and lift up the rubber baffle. The lamp socket can be reached through the scalloped opening in the bumper. If by chance the bumper-to-body clearance is too tight for you to get your fingers in, loosen the bumper-to-frame brace bracket and push the bumper down.

Unneutral

I have a 1970 Ford Ranger LLT pickup. The neutral switch has been replaced six times. It works for two days to three weeks; then it will stick in Park or the engine won't start in any position but Park. Is there a cure for this? I'm not only going crazy, but I'm driving my dealer crazy.—H.E. Mead Sr., Denison, Tex.

That's his fault, not yours. I would think that after installing six new switches he would conclude that something besides the switch is giving the trouble. Here are three possibilities he can start with. First, maybe the attaching screws that hold the switch to the mast jacket aren't tight enough, so that when the activator hits the switch, it causes the switch to shift. Second, maybe the hole in which the activator rides in the shift tube is elongated, keeping the activator from making good contact with the switch. Third, maybe the switch retaining screws have stripped. If so, the switch can be held in place with a radiator hose clamp. Whatever, the trouble is not the switch. Look elsewhere.

Quarterbacking

Hey, Mort, here's a tip to pass on to 1971 Opel 1900 owners being troubled by flooding brought on by percolation. The cause can often be traced to fuel pump overheating. The pump is located behind

a splash pan. If they will have the dealers drill six or eight 3/4-in. holes in two rows in the pan, air will get through to the pump, reducing the heat that builds up. This procedure is recommended by the Buick zone office in Philadelphia.—Coleman Pont, Marlton, N.J.

The tip is passed. Thanks.

Whoa, baby

Ever since the car's been new, I've had problems with the brakes of my 1970 Chevelle Malibu. It has self-adjusting drum brakes. More than ample pressure is needed to stop or slow the car, and at times I have to pump the pedal during a stop. The service shop has been of no help. They say the condition is caused by drum expansion because of heat, but that braking is normal. You're my last hope.—Larry Bruce, Portland, Ore.

I'm wondering if you switched to the Malibu from a bigger car. Although brakes of the Chevelle are adequate for stopping, former larger-car owners can't seem to get used to them. I suggest you have a power-brake assist unit installed. If this doesn't help the situation, I'd have the present brake drums replaced with drums used on the Buick Special. They dissipate heat at a faster rate and should provide a shorter stopping distance.

Car has a mind of its own

I have a 1968 Chrysler New Yorker with 440-cu.-in. engine and four-barrel 4160 Holley carburetor. When I accelerate for passing, the carburetor sticks and the vehicle continues at 50 to 60 mph without my assistance. Placing it in neutral and turning off the ignition rectifies the situation until I accelerate for passing again. The carburetor linkage isn't binding. Can you help?—Hobson S. Lewis, Washington, N.C.

The trouble is probably being caused by an internal leak in the carburetor or sticking secondary throttle blades. Have the carburetor disassembled and inspected for nicks and cracks. Check for varnish on the throttle shafts, nicks on the sec-

[\(Please turn to page 28\)](#)

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FTC Report Aug. 71.

AUTOMOBILE CLINIC

(Continued from page 26)

ondary throttle blades and proper centering of the blades in the throttle bores.

Jumpy transmission

My headache is with a 1969 Dodge Dart Six with standard transmission that jumps out of high gear as I take my foot off the accelerator pedal to slow down. If I hold the shift lever down with my hand, it won't jump out, but I can feel something trying to push it out. I paid Dodge service \$16, but still have trouble. Any solution?
—Harry Urbanick, East Detroit, Mich.

Chances are Dodge service adjusted the

gearshift rods, checked for linkage interference and for a clutch housing bore or face out of alignment. Other possibilities:

Some of these transmissions got into the field with an oversize lever that prevents full travel of the sliding clutch into high gear. To check on it, the transmission top cover should come off the transmission placed in third gear. Note if the poppet ball seats fully in the third speed detent. There should be .002-in. to .015-in. clearance between the face of the lever and the end of the interlock sleeve. If the transmission fails this test, replace the lever with a new one (part No. 1949352).

If this is not so with your transmission, there's one other possibility—worn synchronizer clutch teeth. The transmission will have to be overhauled.

Service Tips

● **Scratch in a car's glass?** How can you tell if it's deep enough to warrant replacement? Chevrolet suggests you run a fingernail over the scratch. If it can be drawn across without catching, then the scratch can often be polished out. See a glazier or try to do it yourself by rubbing the scratch with jeweler's rouge. If your fingernail catches as you draw it over the scratch, the damage is probably too deep and the glass will have to be replaced.

● **A squeaking noise coming from the front of your 1971 Oldsmobile F-85 with V8 engine** may be caused by bolts that are too long and contacting the lower flange of the motor mounts. These bolts retain the mounting bracket to the frame. To cure, install an additional washer under each bolt head.

● **To combat radio interference**, automobile manufacturers agreed in the 1960s to specific electrical emission standards. Resistor cables (Photo 1) were installed in all vehicles. This type cable replaced the then standard cable with a metallic conductor cable (Photo 2). A resistor cable usually has a conductor made of carbon-linen strands, covered by neoprene; this is encased with rubber with a rayon braid for strength, followed by a final jacket of neoprene. Champion Spark Plug Co. advises that care and caution be exercised in replacing cables and has established the following guidelines:

1. Replace a resistor cable only with another resistor type.

2. In removing the cables, loosen the boot first by a twisting action, then grasp it while

carefully removing the cable and terminal.

3. Never puncture suppression cable with a sharp tool.

4. When installing a new cable, insert a wire staple or connector in the end of the cable to make connection between conductor and terminal. (Photo 3). ★ ★ ★



GOT A PROBLEM WITH YOUR CAR? Ask Mort about it. Send your question to Auto Clinic, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. Letters cannot be answered individually, but problems of general interest will be published in the column.

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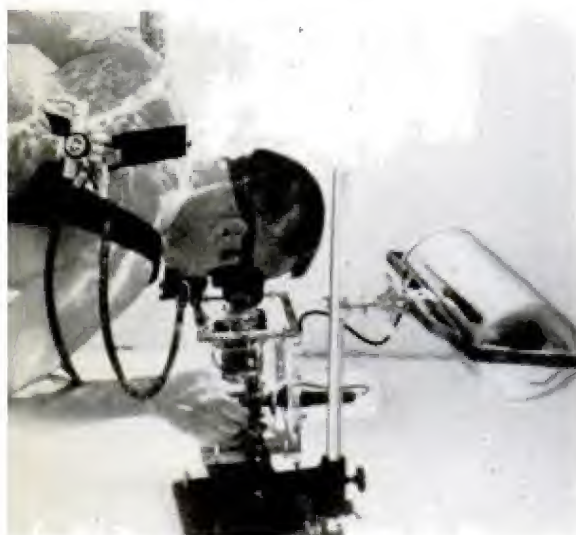


Fiberglass wedges deaden room

AN ANECHOIC CHAMBER—a “dead” room virtually free of echoes—is one of many sophisticated lab facilities in General Electric’s new Applied Research and Design Center in Louisville. The chamber, encased in concrete and mounted on steel springs to minimize ground vibrations, will be used to measure noise levels of refrigerators, airconditioners and other appliances.

IF YOU EXERCISE 15 MINUTES A DAY, 3 days a week, you’re getting the minimum amount of exercise needed to protect you against the possibility of a premature heart attack. So says Dr. Samuel M. Fox III, professor of cardiology at George Washington University, Washington D.C. In exercising, a man should work hard enough to raise a sweat and deepen his breathing, but not hard enough to make the heart pound and lungs gasp. Much research remains to be done to determine the precise benefits of exercise, according to Dr. Fox.

HOW DO YOU OBSERVE SEA ORGANISMS without removing them from their environment? You build a microscope system that can be used underwater for on-the-spot examinations. That’s exactly what scientists at the University of California, Santa Barbara, have done. The ‘scope is enclosed in a transparent plastic box with controls operated by means of watertight apertures. Batteries power the viewing light. The instrument, to be used for the study of sea life and pollution effects, reportedly has worked well in tests run in a swimming pool.



Novel way to study sea life

A NEW METHOD OF DRYING FOODS, reportedly more economical than freeze-drying, has been developed by General Foods Corp. researchers. Called “pressure freezing-air drying,” the method involves saturating foodstuffs, under pressure, with nitrogen. After the food is frozen, it’s air-dried. Retention of shape and appearance is similar to that of freeze-dried products but the new method is less costly because it does not require processing in a vacuum, as does freeze-drying. The new process can be used on foods such as carrots, celery, rice and chicken.



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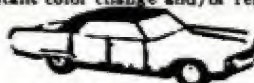
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DETROIT

LISTENING POST

BY ROBERT LUND

WILL OLDS GET THE NOD over Chevy as the first GM division to offer a Wankel? Probably not, although the idea isn't as far out as it seems. In the latest phase of its Wankel development program, GM's teamed the rotary piston with front-wheel drive. An agent on the inside says the front-wheel-drive version has it all over conventional rear-wheel drive in handling. Olds has more experience with front-wheel drive than any other GM division. But GM figures all the angles and one question it's sure to consider in tossing the coin to decide which division gets first crack at the Wankel is what the repercussions will be if the engine bombs out. Chevy has the volume so it could recover from an Edsel-size flop. Olds isn't that big. So you can put Olds down as a candidate to pioneer the Wankel, but don't bet big.

There's still the problem of developing seals for the Wankel before it can be put in production. GM's far from satisfied with the seals it's come up with so far, contrary to reports that the sealing problem's been solved. A supplier who has a remote connection with the GM program describes the situation on seals this way: "When they started out, seals were blowing at 8000 miles. Now they're up to 30,000 to 40,000 miles. But that's still 10,000 miles short of what GM would consider a minimum, and they're shooting for something well above the minimum."

PINTO STATION WAGON will be in Ford showrooms within the month. The Squire model shown below is the dress-up version featuring simulated-

wood side panels. Standard in the wagons will be the larger Pinto engine, the 2000-cc (121.6-cu.-in.) in-line Four. On the same wheelbase as the Pinto sedan models, the wagon will have increased rear overhang to bring overall length to 172.7 inches. Cargo area dimensions with rear seat folded are 69.2 inches long, 42.5 inches between wheel-houses and 31.5 inches maximum cargo height. Cargo volume is 60.6 cu. ft. Tailgate is one-piece, top-hinged with fixed rear window.—B.H.

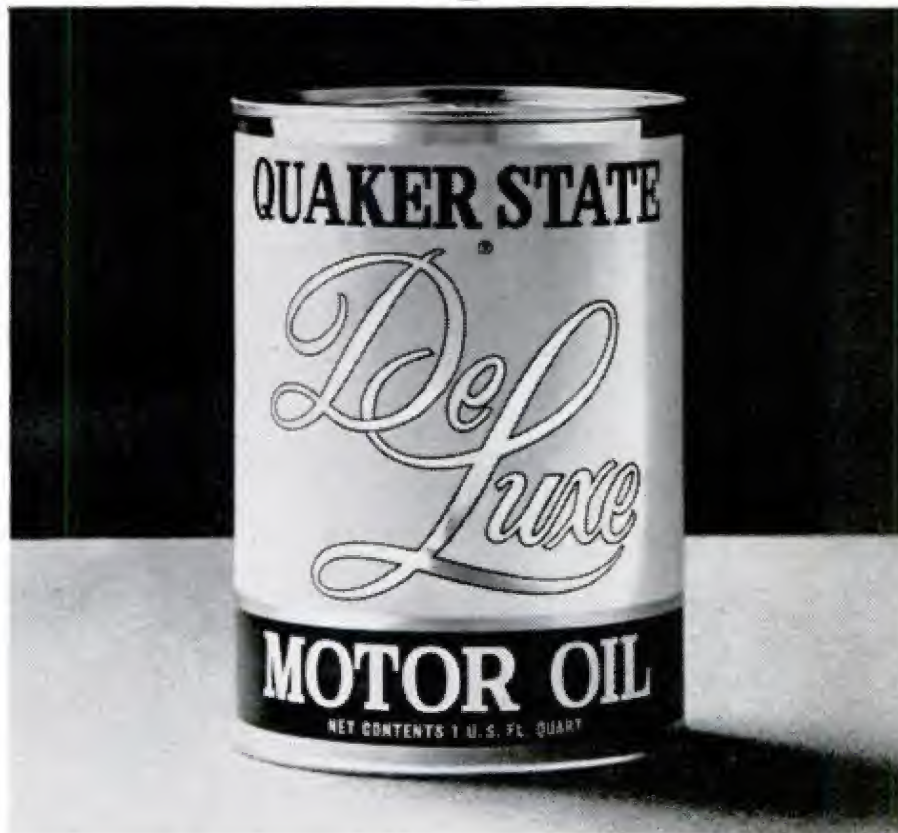
WHAT THE AUTO BUSINESS NEEDS now is another Mustang. Not the current Mustang, but the original—a sporty, new-shaped, new-looking car priced as close to \$2500 as possible and definitely under \$3000. Three of the four auto firms—Chrysler's the exception—are working on son-of-Mustang-type cars for 1974-1975. Make that plural, because GM has three of them on the boards. Don't confuse the "economy" sportsters with the smaller-than-Vega, smaller-than-Pinto cars coming in a few years. They're in addition to the sub-shavetails, not replacements for the American-style VWs.

SUB-MINIS MAY BE DELAYED a year or two. They're coming for sure. But when? The finance committees at GM and Ford want their money back on Vega and Pinto before approving new outlays for still smaller cars. The sales departments argue that they need the minimachines by fall of '73, as '74 models. But the money men want the tooling bills paid off on the little cars that came out two years ago before they reach in the sock

(Please turn to page 38)



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(Continued from page 36)

for another stake. Henry Ford II has the clout to override the finance committee at Ford. But nobody tells the finance committee what to do at GM.

SINGLE ACCESS DOOR for front and rear seats—one big door instead of two little slabs—is an idea Ford's looked at for its under-Pinto-size car. Forward edge would be hinged at the A pillar; back section at C post. Sounds like a try-it-on-for-size idea that's likely to get pitched out in the final wrap-up.

THE DOUBLE-DOOR IDEA makes sense, if auto companies hope to salvage the two-door car. This body style appears doomed because of an upcoming government regulation requiring a solid metal bar mounted across the back of the front seat to protect the driver against rear impact. Using a solid bar, front seats couldn't be folded forward to allow entry to the rear. GM's already let leak it will convert its two-door hardtops to four-doors this fall. But the two-door may be "re-invented" in a few years. Engineers are trying to work out a compromise to satisfy the safety regulation and permit two-door production. How? By designing the impact bar across the back of the front seat so it can be released to telescope or fold when the front doors open.

GOVERNMENT GOOF-UP? Has anyone in the Department of Transportation, where they write the rules for the auto companies, tumbled to the fact that rear bumpers on the '73 cars may not be as good as those on the '71s and '72s? The DOT standard effective next September requires rear bumpers to take an impact of 2.5 mph without damaging the sheet metal. Many current cars, and even some earlier models, can take a 2.8-mph ram in the rear without crinkling the sheet metal. So if the industry follows the DOT standard on '73 models, rear bumpers will be more fragile than now. This is progress?

FORD'S ABOUT DECIDED to give up on its mid-engine Pantera, despite a ready market for all copies coming in from Italy. It will market the car as long as the law allows, but the cost of making it over to comply with regulations for '74 and '75 indicates a phase-out.

MISERY DETROIT-STYLE, as defined by Bob Orben: "That's when you spend \$50 million to bring out a new car and the first one off the line is sold to Ralph Nader!" ★★★

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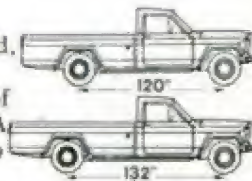
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Drivin' with Dan

What are roll understeer, oversteer? Which courses should new race drivers study? Does experience in drag racing help drivers in oval or road races? Dan Gurney answers these and other automotive questions

Q: *If you have a stock 1968 Chevy Malibu with a 200-hp, 307-cu.-in. engine and a stock 1970 Chrysler 300 with a 375-hp 440-cu.-in. engine, both with automatic transmissions, which would win in a quarter-mile race? What would you say is the fastest American production car?—John Haynes, Northridge, Calif.*

A: Of course, at first glance the Chrysler looks like the winner, but you must race them to be sure. I'd guess the fastest production car in the United States would be the big Corvette.

Q: *In November's PM you told a young man how to start driving. I've been an avid racing student for two years and have been around demolition derby cars and stock cars, as well as supermodified hardtops. Are there any driving schools for women?—Edith Casterline, Dixon, Calif.*

A: I don't believe there are any such schools that are exclusively organized for women. Most of the existing schools would be happy to have a young lady have a go at embarrassing the men.

Q: *Has the Indy 500 ever been won on any other tires than Goodyear?—Rusty Ketchum, Canoga Park, Calif.*

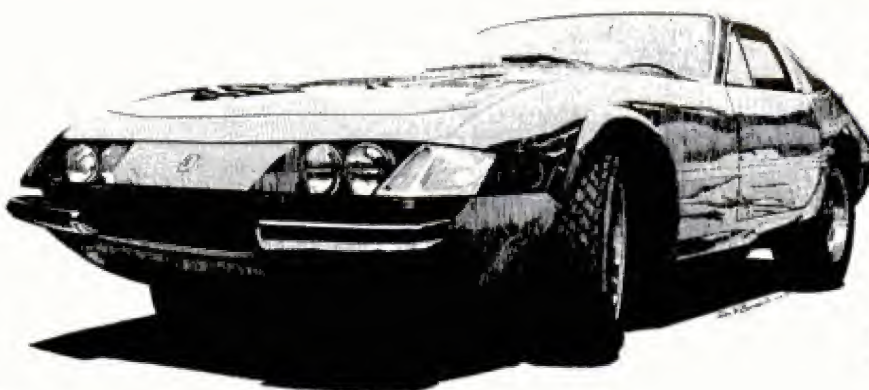
A: Sure. Firestone has won Indy many times;

in fact, for quite a spell it was the only company building Indy tires. Goodyear has been at Indy since 1964 and its participation has heated up the competition to a real fever pitch. From Indy this competition has spread to Grand Prix and Can-Am racing. Goodyear has won more NASCAR stock-car races than any other outfit by far in recent times.

Q: *What do roll understeer and roll oversteer mean? And what does roll have to do with a car's stability on the road?—Benjamin Chouake, Forest Hills, N.Y.*

A: The first two terms usually refer to what happens to the wheels (mostly rear wheels) when the car is forced down on the suspension on the side nearest to the outside of a turn, and forced up on the suspension on the inside of a turn. The wheels actually steer a little bit. Understeer turns the wheels slightly toward the inside of the turn; oversteer turns them toward the outside. Roll affects different cars in varying amounts. Most racing cars roll less than passenger cars. Some drivers prefer more roll than others.

Q: *Could you name some of the important engineering courses that relate to auto racing? What other courses should be studied if you are*
(Please turn to page 42)



DAN DRIVES AGAIN! In the Cannonball Baker Sea to Shining Sea Memorial Trophy Dash (New York to Los Angeles), Dan and co-driver Brock Yates took first place with a time of 35 hours and 54 minutes—a new unofficial record! The car was a Kirk F. White Motor Racing Ferrari 365 GTB/4 Daytona. (This drawing of the car was done by artist John W. Barnes Jr. For information about prints, write to him at Box 323, Scarsdale, N.Y. 10583)

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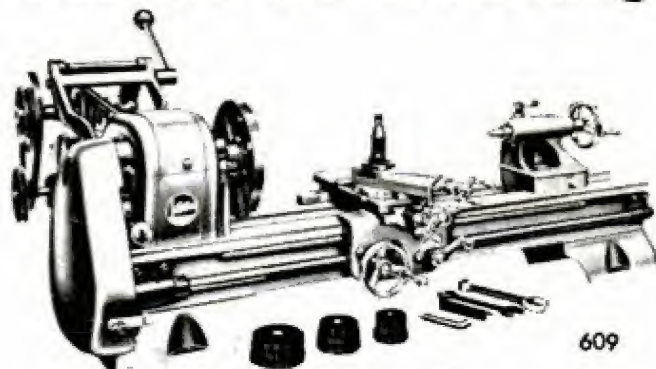
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DRIVIN' WITH DAN

(Continued from page 40)

planning to become a race driver?—Ken Demartyn, Enola, Pa.

A: There are more courses available than I could possibly suggest. Some that would be helpful are metallurgy, chassis engineering, suspension engineering, aerodynamics, heat dynamics and machine design.

Q: I can't see that drag racing, even in the AA fuel dragster or funny cars, is of any help to someone who wants to race ovals or road courses. What do you think?—Lee Osterman, Rockford, Ill.

A: I think it is bound to teach you many things about vehicles that will help you on ovals and road courses. On the other hand, oval and road-course experience would not necessarily make you a great drag racer.

Q: I run a VW off-road and I'm curious as to how much "straight pipe" length you can run without burning up your valves.—James Perkins, Rutland, Vt.

A: To the best of my knowledge there is no limit.

Q: I am interested in the Chaparral Ground-Effect Car. Could you tell me where I can get information on it?—Bill Schuck, New York.

A: Write to Don Gates of Antares Engineering, Jackson, Mich. He is the originator of the Ground-Effect Chaparral.

Q: There was a race on television where cars were racing on a frozen lake without special tires or adjustments. I think it was in Michigan. What type race was this and where can I get information about it?—Dennis Matt, Lyndhurst, N.J.

A: I'll bet there were plenty of bent fenders and that slowing down was a real chore! You can find out more about it by reading Dick Bauer's *Learn About Winter Driving from the Ice Racers* (page 76, Dec '71 PM).

Q: Recently, I read that a good way to get the motor started on cold mornings is to turn the lights on for about 30 seconds, and then off. The article said this motivated the electrical system and provided a good charge for the motor when

(Please turn to page 44)

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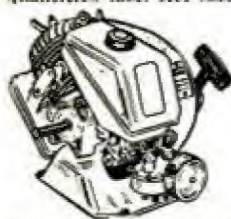
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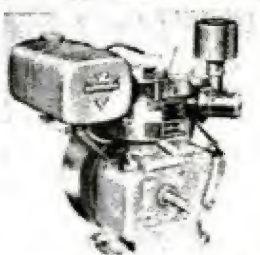
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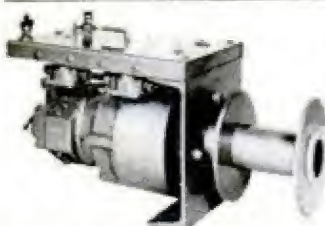
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DRIVIN' WITH DAN

(Continued from page 42)

the starter is activated. Does this make sense to you?—Warren A. Reeder Jr.

A: No. Don't do it.

Q: I am only 14 and would like to know if I can get a license for a trail bike in Pennsylvania.—T.J.R., Hazelton, Pa.

A: Check your State Dept. of Motor Vehicles to be sure, but most states do not require that a motorcycle be licensed if it is not to be used on public streets or highways. In other words, you probably don't need a license at all, regardless of your age.

Q: How do you get information about Grand Prix racing, Formula 1 cars and international Grand Prix tracks? Which racing magazines do you think have best coverage?—Glenn Brooks, Calhoun, Ga.

A: I subscribe to several racing publications which should answer both your questions. They are, Auto Sport, Craven House, 34 Foubert's Place, London W.I., England; Motoring News, Standard House, Bonhill St., London E.C. 2, England; Competition Press & Auto-week, Autoweb Building, Lafayette, Calif. 94549; Road & Track, Bond Publishing Co., 1499 Monrovia Ave., Newport Beach, Calif. 92663; and Motor Sport, Standard House, Bonhill St., London E.C. 2, England. A publication giving thorough coverage of U.S. racing of all types as well as international events is National Speed Sport News, News Building, Ridgewood, N.J. 07451.

Q: What is the "Olsonite" that I have seen on your cars for years? Is that the type of Eagle?—Jimmy Scott, Kildare, Wyo.

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If you have questions on racing, high-performance and everyday driving techniques, send them to "Drivin' with Dan," c/o Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. Questions cannot be answered by individual letters. Questions on maintenance and repair should be addressed to the Auto Clinic (see page 26).



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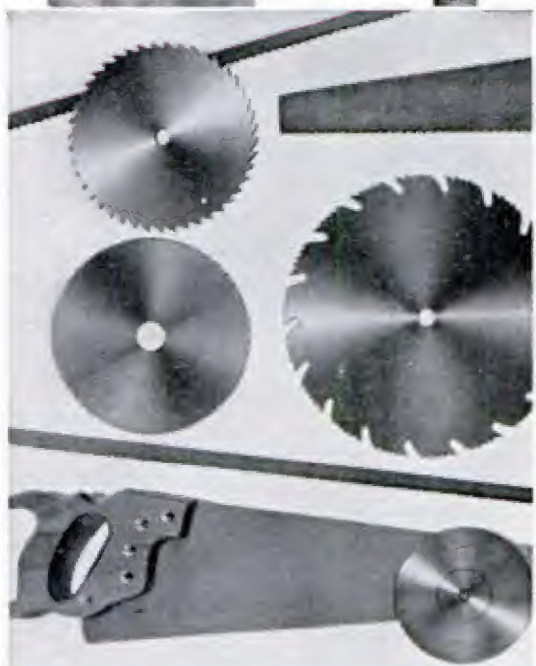
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After the



LIFT-OFF TOP of the new Triumph Stag leaves a padded roll bar for protection in rollover accidents, and increased structural rigidity of the entire car. Less stressing and twisting of the body means fewer potential rattles to develop. The British-built Stag offers the versatility of an open car/closed car and is one of the few "convertibles" now available that has the additional feature of a respectably sized and comfortable back seat. The attentive, belted-in young boys are getting the idea that driving can be safe and still be fun!



SNEAK PHOTO of a '73 General Motors intermediate hardtop during tests reveals a wide "B" post between front and rear side glass. Beefed-up pillar will help the hardtops meet the 1973 federal rollover standards. Reported to be an Oldsmobile Cutlass model, the car is likely to be offered with sunroof option. Sunroof installations in new cars for the '72 model year will more than triple those for '71

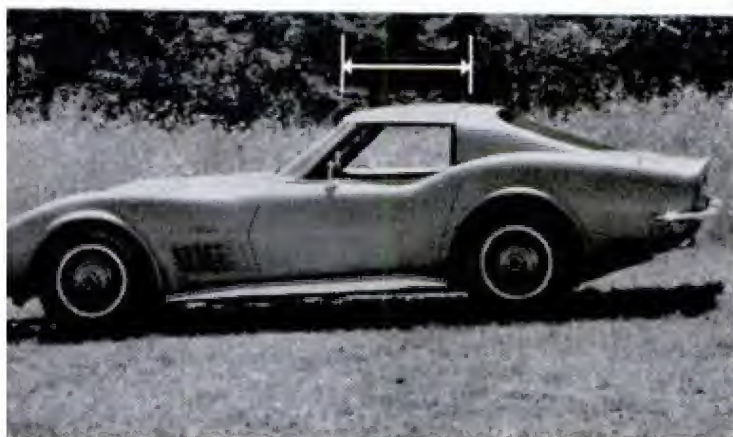


SLIDING STEEL SUNROOF on more expensive domestic models is electrically operated. Those offered on compact and subcompact cars are most often of folding vinyl. Vinyl isn't burglarproof so insurance companies don't like it. The big boom for '73 and '74 model years will be the manually operated sliding steel roof such as that used by VW—solid, tight and easily rolled back with a folding hand crank

convertible-what?



LOOK MA, ONE HAND! Removable fiberglass roof on the mid-engine Porsche 914 (above) is lightweight and one piece. It stows in the car's rear trunk on special clips (below), leaving luggage space under it. The ideal configuration for open-car sportiness and closed-car comfort, the Porsche solution is also solid and safe since the disguised roll bar and backlight are integral with the car body. Two hooks on windshield frame and two in roll bar firmly secure the roof and quickly release so that it can be removed



TWO ROOF PANELS on either side of Corvette lift off and leave an integral roll bar and a center support between roll bar and windshield. Backlight also pops out and stows behind seats with roof panels

Alas, there are no more Dodge, Chrysler-Plymouth or American Motors ragtops; Ford's 1973 convertibles are likely to be their last and GM's will be next to go. How's a sport going to get some wind in his face?

By **BILL HARTFORD**, Auto Editor

WHO KILLED THE CONVERTIBLE?

It was all of us easy riders who opted for the soft ride over the soft top: We'd rather shut out the sun and turn on the airconditioner; rather power up the side window than choke on gusts of soot; and rather drive the high-speed pikes aerodynamically buttoned down than top down.

Or maybe you've had your soft top slashed? If it hasn't happened to you, your insurance man can tell you how often it's happened to others. And how about the structural problems and rattles of topless cars—and leaks and drafts?

Maybe you don't mind a draft and a stiff neck, but how about saving your neck in a rollover accident. Government safety requirements for occupant protection will smite the final blow to the soft top. If you can remember laying on that ol' top dressing and squinting through a discolored and cracked backlight—zap!—you're an old-timer. Domestic convertible sales are down to about 76,000 in '71 from their big peak in '65 of 507,000!

But the dream of the "red convertible" is practically genetic. And therefore the soaring demand for more practical yet exciting solutions to the perennial open car/closed car dilemma, some of which are shown here.

The hottest option for open-air driving is the sunroof. Long popular in Europe, the hole in the roof is proliferating here. Likely to be available soon on most if not all domestic models, the sunroof is either folding vinyl, manually operated sliding steel or electrically operated sliding steel.

Other approaches are removable roof panels or even completely removable tops that let in the sun but still leave a built-in roll bar.

Whatever the configuration, sporting motorists, you can still have the option of being rained on!

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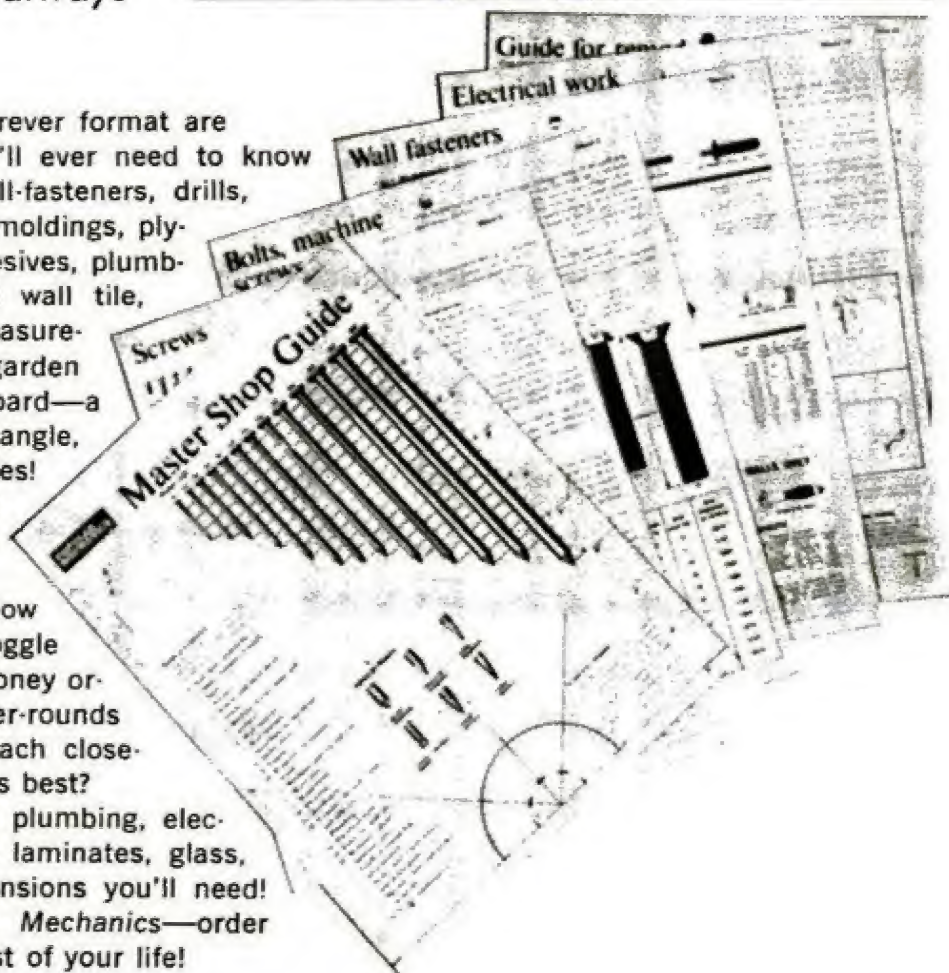


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ALL OUTDOORS

By BILL McKEOWN

BACKPACKING IS BOOMING as more outdoorsmen try to get away from crowds of other less-athletic campers. The backpackers are being helped by a number of new, extra-light, extra-strong items.

Tenting used to mean toting a bundle of weighty canvas. Now it's been pared down to a neat nylon stuffsack or handful that needs to check in under five pounds to meet the competition. Coleman, Camp Trails, Trailblazer by Winchester, Sears, Thermos, L.L. Bean, Wenzel, Himalayan of The Leisure Group are among designer-producers of the small one and two-man shelters that tie to a pack or fit in one. Then for carefree kids or emergency use, there are plastic jobs that can be folded to the pocket-size of a pack of cigarettes.

A plastic man-length with a ridgepole rope strung through it between two trees is just about minimum overnight protection. Unfortunately, however, discarded tube scraps are already starting to litter wilderness areas. Ski Hut in Berkeley, Calif., has come out with a 34-oz. waterproofed fabric tube with longer life that's reported to weigh even less than the easy-to-tear plastic.

FOUR-WHEEL CONVERSION KITS now available mean that snowmobiles don't need to go into warm storage. It's no secret that some owners drive their machines as-is on grass in summer and use them over dry leaves during hunting season in the fall. But ski steering is difficult without snow, and some makers will void your warranty since gravel can tear up the belt track. The kits, however, lift the machine to convert it into a kind of go-cart. Land-Grabber in Windon, Minn., has a new fat-tire wheel kit for about \$320, and for \$40 more it can convert a snomo trailer when winter rolls around again. Kiekhaefer Aeromarine is also reported to be developing a high-speed conversion.

PROFITS FROM OUTDOORS PRODUCTS are mounting up and it may be time for some of the big producers to help in outdoor facility development and environmental protection. As John Ebeling of Winnebago Industries pointed out recently, an organization of outdoor recreation industry members could do a lot to promote procurement and development of public lands for best public use. Sounds like good sense as well as good business. Here's one vote in favor.

FINDING WHERE THE ACTION ISN'T is supposed to be a real chore, as anyone at Yellowstone or Yosemite last year would agree. But the National Park Service has come up with a list of less-visited parks, monuments and recreational areas that we rate as an outdoors insider's tip sheet of best bets for uncrowded camping this summer.

Sure, Grand Canyon facilities can get crowded, but have you seen the Canyon from the equally spectacular North Rim? . . . Just 130 miles east of Yellowstone National Park are the wild gorges and landscapes of Big-horn Canyon National Recreation Area. It extends 41 miles through river canyons and around the reservoir formed by the Yellow-tail Dam as it straddles the border between Wyoming and Montana. . . . Or only 80 miles north of the Great Smoky Mountains National Park is the lesser known Cumberland Gap National Historical Park, site of Daniel Boone's Wilderness Road where Kentucky, Tennessee and Virginia come together. . . . It's blazing in the summer, but winter visitors can enjoy the remote Big Bend National Park in Texas along the Mexican border following the Santa Elena Canyon of the Rio Grande. . . . Save summer for a visit to the thermal springs and mountains of Lassen Volcanic National Park in Northern California, the North Cascades Park and National Recreational Areas around Ross Lake and Lake Chelan near Washington's Canadian border, or Mount McKinley National Park in Alaska if you really want to get away from it all.

Want to skip the country? Outside the continent are Haleakala National Park on Maui in Hawaii and Virgin Islands National Park on St. John, and you still haven't left the United States. . . . Get away from it all on an island that doesn't even allow Detroit's machines by heading north from that city to Michigan's Canadian border and Isle Royale National Park, accessible only by boat or float plane. . . . Then camp Mexico and Canada before complaining again about crowds.

WHEN YOU HAVE TO STAY INDOORS, there are still plenty of vicarious outdoor kicks in a number of new books and directories available for planning ahead. Makens' Guide to U.S. Canoe Trails describes thousands of miles of suitable waterways along 900 rivers in 49 states. It is \$4.95 at bookstores or through Grumman Rent-a-

Canoe dealers. Winchester Hunter's Handbook, 1972 has 100 pages of complete state and provincial game regulations, seasons and prospects for all 50 states and 11 Canadian provinces, as well as bow-hunting seasons and regulations and a section of Winchester ballistic tables. It's \$1.95 at bookstores, sporting goods dealers and newsstands. A good introductory booklet for boys and girls is available for 25 cents from the National Shooting Sports Foundation, Riverside, Conn. Called Shooting's Fun for Everyone, it gives basics in safety, selecting a beginner's rifle and where to find expert instruction.

REMEMBER WHEN you drew a blank or a deluge of double talk from your friendly car dealer a few years ago if you asked about trailer towing or pickup camper capabilities? Now all the majors have bulletins or booklets like Ford's 24-page Recreation Vehicles 1972, Chevy's quarterly Chevy Camper magazine, Dodge truck brochures, Oldsmobile's Your Way to Tow in '72, American Motors' 1972 Trailer-Towing Bulletin and others. Any dealer should have them on hand, and a pleasant evening's homework with them will tell you the questions to ask and maybe the rig to buy as well.

GOOD REMINDERS for long-time recreational vehicle owners and useful tips for beginners are included in a checklist from the RV Industry's Recreational Vehicle Institute. Backing up is the biggest initial bugaboo with any new oversize vehicle, and an empty weekend parking lot is a good place to practice before you hit the highways. Going forward in traffic, stay about 200 feet behind the car ahead and pull over if you're slowing a line of traffic behind. When passing, give yourself a lot more open road before pulling out and then use your big mirrors before turning in ahead.

Use the good campground directories like those from Rand McNally, Woodall's or AAA, and pick your evening stop early. An RV trip isn't supposed to be a marathon so, particularly at first, don't try for more than 200 to 300 miles a day. Noon is none too soon to call it a day if you want space mid-season at a popular campsite. Fifty mph is a good cruise speed.

When loading up, don't forget water and LP tanks. Fill water slowly to prevent an air block. Stow heavy items down low, of course, toward the center of your rig. Stuff crumpled newspapers, blankets and pillows into shelves and cupboards that hold breakables. And for more good advice? Ask the man at the next campsite. ★ ★ ★

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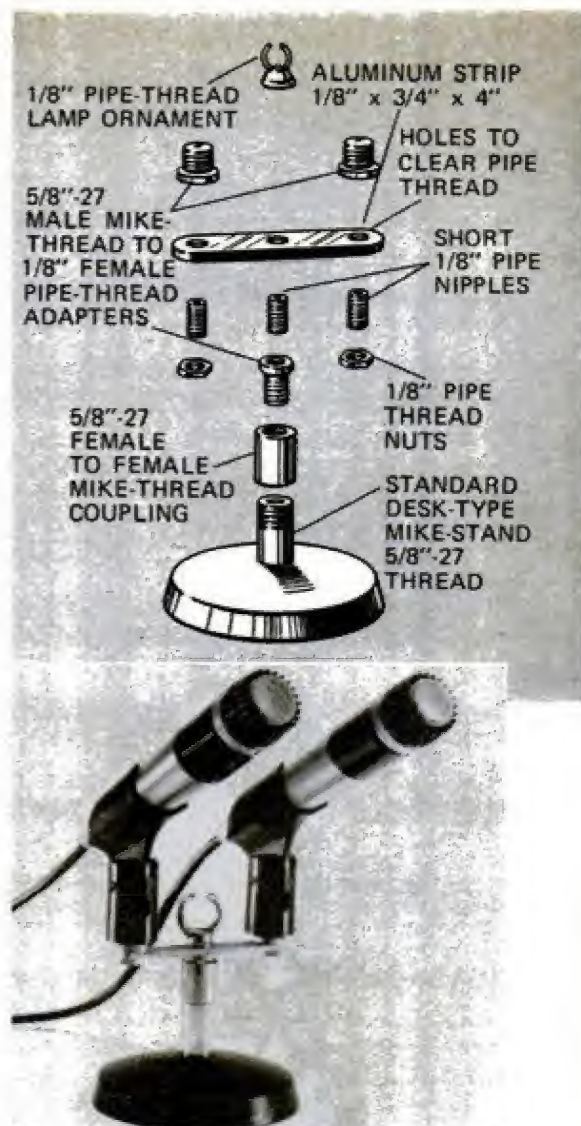
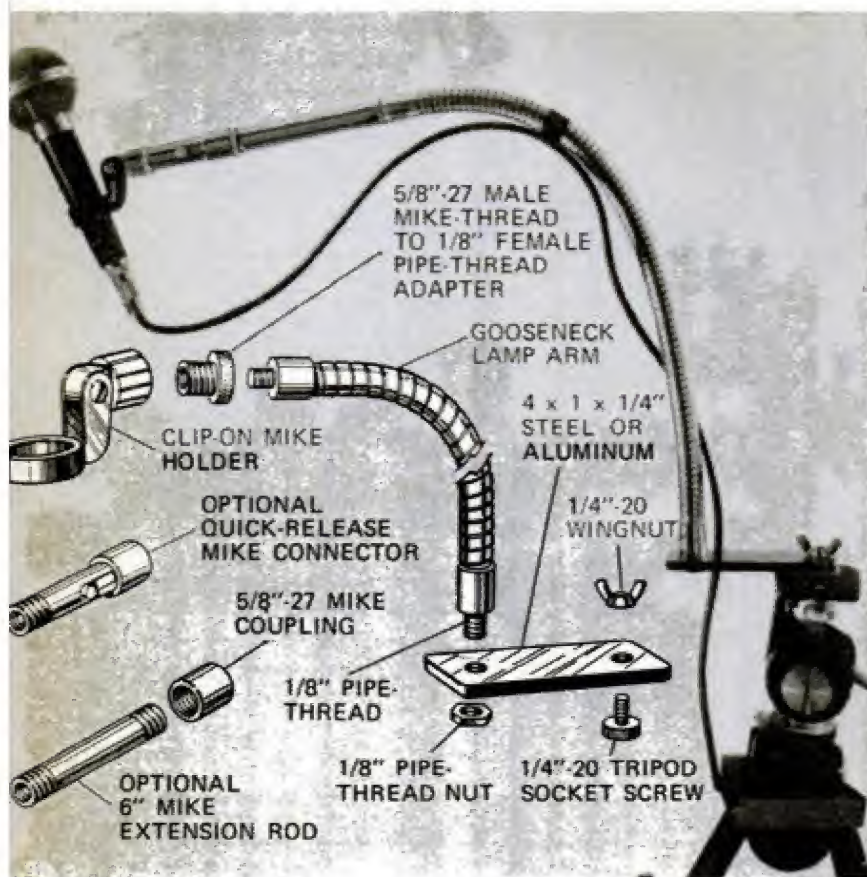
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Electronic Hints



Three special types of mike holders you can make yourself

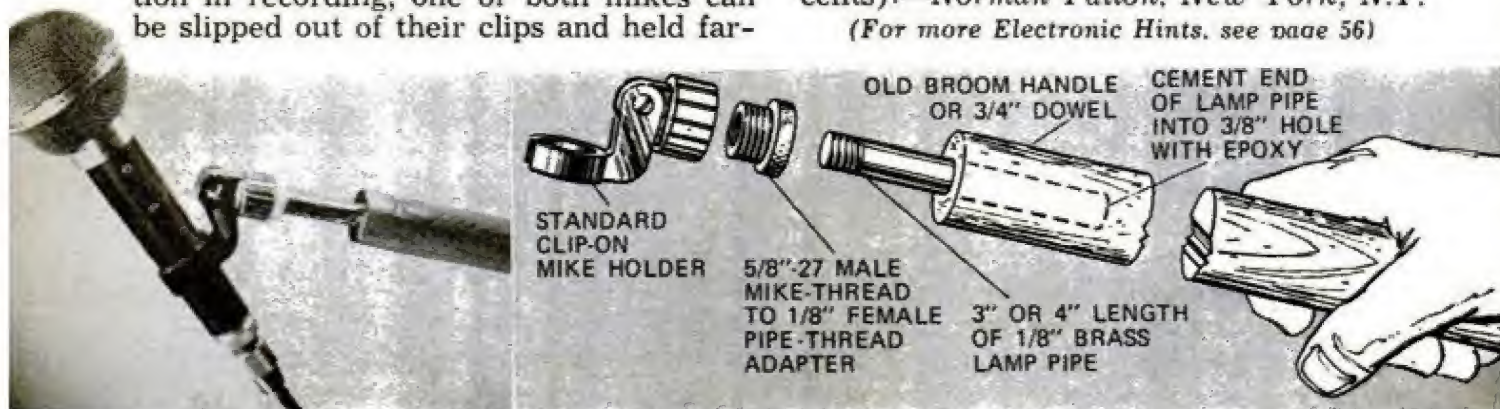
Professional mike stands are expensive, but you can make these simple holders for practically nothing from readily available hardware. The one at left, above, uses an ordinary lamp gooseneck with a bracket that can be attached to a tripod. The tripod provides a steady floor stand, and the gooseneck serves as a flexible boom, leaving your hands free to operate recording or other equipment.

The dual mike holder at right, above, is handy for stereo recording and is adapted to fit on a standard, inexpensive desk-type mike stand. For wider separation in recording, one or both mikes can be slipped out of their clips and held far-

ther apart. The hand boom below, made from an old broomstick, is useful for picking up sounds at long reach, such as from different musical instruments in a band or different voices in a party crowd.

The gooseneck and 1/8-inch brass pipe are stock lamp items available at hardware and electrical stores. All three holders require one special adapter fitting to mate the 1/8-inch pipe thread to 5/8-27 mike thread. These adapters are made by Atlas and available from Lafayette Radio, 111 Jericho Turnpike, Syosset, N.Y. 11791 (Type AD-2; No. 44R10197; 62 cents).—Norman Fallon, New York, N.Y.

(For more Electronic Hints, see page 56)



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Electronic Hints continued



Toothbrush makes handy cleaner

An old toothbrush is a perfect tool for cleaning up printed circuit boards after soldering connections. It will remove loose bits of solder and wire that might be the cause of damaging shorts in the circuit. It will also brush away dust and corrosion from those hard-to-reach places in electronic equipment and electrical appliances.

—Marshall Lincoln, Wickenburg, Ariz.



Portable fuse box goes with you

If you have unfused electronic equipment or electrical appliances and aren't sure how much current they draw, this accessory fuse box will give you portable protection wherever you go. Mount a cartridge-type fuse holder in a small metal box along with a flush-mount receptacle and a power-cord clamp. The fuse holder is simply wired in series with one lead from the power cord to the receptacle. Fuses of various values can be inserted interchangeably in the holder to suit different conditions, such as to protect a specific piece of equipment or to avoid overloading a circuit that might cause fire.—Norman Fallon, New York, N.Y.



Neat organizer for small parts

Searching for tiny parts in electronic kits takes considerable time. This simple rack makes such parts easy to organize and identify. Tape two pieces of cardboard together to form a V-shaped stand. A string keeps the bottom edges from spreading too far apart. Use double-sided tape and stick the parts on the exposed side in neat rows.

—Ken Patterson, Regina, Sask., Canada.



'Manicured' contacts work better

The emery boards ladies use for manicuring fingernails are ideal for cleaning corrosion off appliance plugs, batteries, radio-tube pins and other electrical contacts. They're much safer than the use of files, which tend to remove too much metal.—Robert Hertzberg, Flushing, N.Y.

Asbestos padding holds in heat

When clamping parts to be soldered in a vise, pad the jaws with bits of sheet asbestos. They'll prevent heat from being conducted rapidly away by the metal jaws, thus making the soldering job easier.—Wilfred Beaver, St. Anne, Ill.

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FISHING & BOATING — The new Heathkit Thermo Spotter lets anglers find the specific water temperature level where trophy fish feed. The new Digital Depth Sounder reading to 199 ft., costs about half the price of other units. In addition there are Heathkit flasher-type depth sounders and fish spotters, power inverters, hailers, VHF phones, etc.

STEREO — The new Heathkit AR-1500 stereo receiver experts hail as the most sensitive and powerful, heads up a complete line of receivers, amplifiers, tuners, turntables and speakers in every price range, 4-channel and tape components, too.

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APPLIANCE CLINIC

By PAUL MANN

Throwing knives

Every time I use my Sunbeam electric carving knife the blades fall out when I turn it on and try to cut a piece of meat. I would appreciate knowing why this happens and what I should do about it.
—Paul McAlear, Jamaica Plain, Mass.

There is a small outward protrusion near the rear of each blade that snaps into a rectangular hole in a flat spring. This provides spring tension to hold the blade in position. Your problem may be that you are simply not pushing the blades in all the way. Push in each blade individually until it snaps into position. Handle blades only by grasping the plastic drip guards. If this fails to solve your problem, the protrusions on the blades may be worn or the flat springs may need adjustment.

Pooped out corn popper

We received a West Bend automatic see-through corn popper as a gift last year. It worked only once, so we sent it back to the factory. After it was returned, we used it—once. After that, it again refused to work. What can be wrong, and how can it be corrected?—John H. Young, Dixon, Neb.

A corn popper is one of the most uncomplicated of appliances. The lower part of the unit is a metal bowl that contains a single heating element, while the upper part usually consists of a dome-shaped glass cover that you can look through to see when all the corn has been popped.

What can keep the instrument from working? The line cord may be faulty, which is probably not the case with your unit. Neither is it likely that there's a short circuit. You don't complain of fuses blowing or circuit breakers tripping. This leads us to the possibility that there is a bad thermostat or an open circuit within the heating element. The element should be tested with a voltmeter or a multimeter.

If the test shows an open circuit, the question that has to be answered is why is it happening after the appliance is used

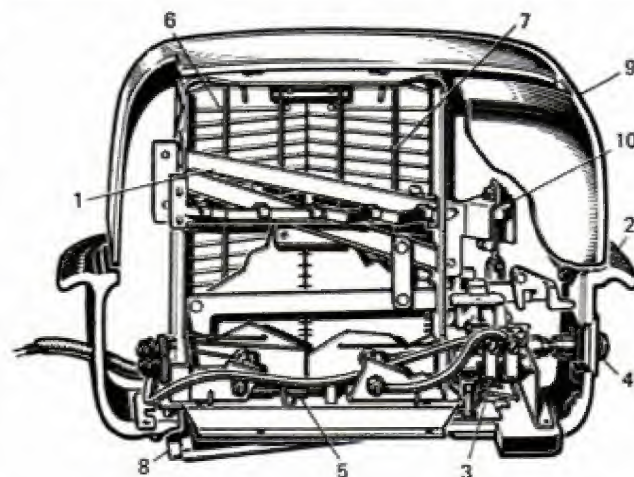
one time only? Unless actual physical damage is being done to the unit, an open circuit most times will occur if the appliance is drawing excessive current. Resistance is purposely built into the unit to safeguard against this. Thus, there is the chance that the defect may have been in the manufacture. Perhaps a resistance wire was accidentally omitted or a wrong resistance used.

Before you ship the unit back to the factory with a complete explanation, check one other thing. Is there anything peculiar with the electrical service in your area that may be causing voltage surge? Call the service department of your electric company and describe your problem. Maybe they can explain it.

Cooked toast

How about a rundown on a two-slice pop-up Toastmaster toaster, model 1B12, that suddenly stopped ejecting on time, leaving us with burnt toast?—Oscar C. Cook, Oklahoma City.

Sure. When you place bread on the rack of a pop-up toaster and push the handle down, dropping the rack and bread, the rack closes contact points on a timer and current begins to flow through the elements (see the accom-



1, rack; 2, operating handle; 3, timer; 4, timer adjustment; 5, spring; 6, heating element; 7, guard wires; 8, bottom cover; 9, housing, and 10, damper

panying diagram). At the same time, the rack engages a mechanical latch that holds it down.

Length of the toasting time is controlled by the timer adjustment. When the cycle is completed, the timer trips the latch and a spring raises the rack. The rack slides up, opens the circuit shutting off current to the elements, and provides you with toast.

What can upset all this electrical and
(Please turn to page 58D)

TOM McCAHILL SAYS:

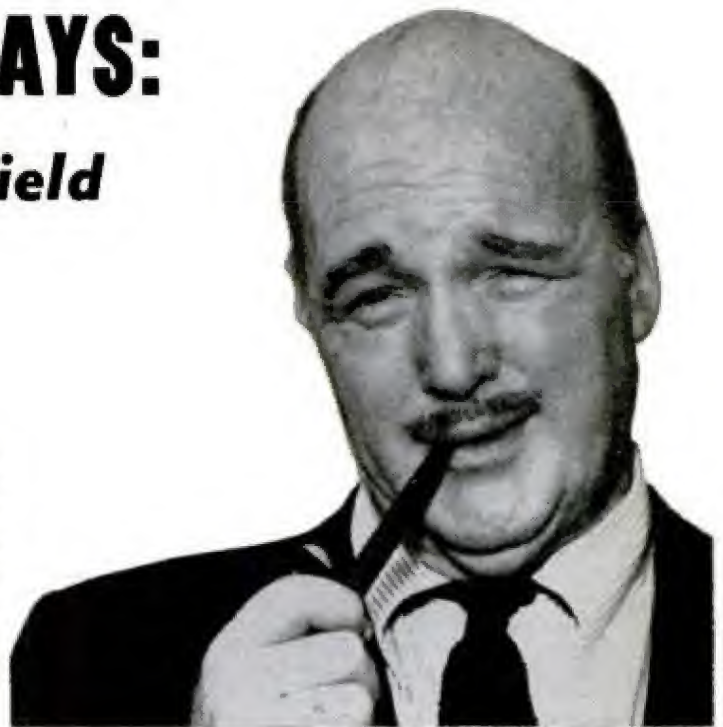
**"The appliance repair field
is so uncrowded
it's almost lonely!"**

Someone once said that if you build a better mousetrap, the world will beat a path to your door. In the home appliance business, a lot of enterprising companies have gotten rich peddling a list of handy electrical gadgets for the home longer than Wilt Chamberlain's arm. The trouble is, the dozen or more appliances in the average American home can go on the fritz, and men with the proper training to do repairs are as scarce as knee-length skirts on teen-agers.

Good Appliance Repairmen are a rare breed these days. Those with a little ambition are booked so solidly you can wait days to get somebody to fix a balky refrigerator or cantankerous toaster. Sometimes, you have to settle for a bum job from a guy who had no business calling himself an Appliance Repairman in the first place.

This brings me to my point. If you want to make money in a field that's begging for trained technicians, there's a fine, low-cost home-study plan available that teaches you how to handle every type of Appliance repair in detail—including refrigeration, air conditioners, and even small gas engines. The course was prepared by the instructors at National Radio Institute. This is the oldest and largest home-study school in the Electronics/Electrical fields with more than fifty years' experience training men like yourself for new careers or spare-time or full-time businesses of their own.

A few years ago, NRI recognized the increasing demand for trained Appliance Repairmen. They set about preparing well-illustrated, easy-to-understand lessons that teach you how to repair home, commercial and farm Appliances. NRI even added a professional Appliance Tester that's included in their low tuition. With the Tester and a few basic tools you probably already have,



you're equipped to service most Electrical Appliances. If you aren't making as much as \$4 to \$6 an hour in spare time fixing Appliances for friends and neighbors within a few months after enrolling, my name isn't McCahill.

The reason I'm no doubting Thomas, is because the staff at NRI is composed of experienced instructors who guide you through the course with more personal attention than you'd get in many classrooms. With the kind of help they give a student and the kind of course they have, you can be the man in demand in this field—even if you've never tried to rewire a plug, or got fed up with school at the 9th grade.

The best advice I can give you is to clip the coupon below and send for the NRI Appliance Training Catalog. It's free, and there's no obligation. NRI doesn't employ salesmen, so nobody will be knocking at your door. All it will cost you is a postage stamp. Take it from Uncle Tom, the Appliance Repair field needs good men. Now.

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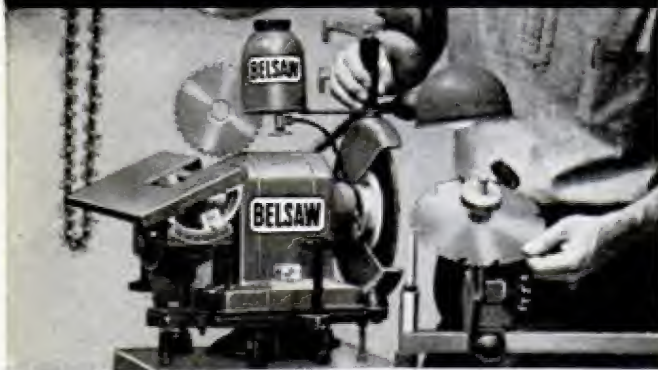
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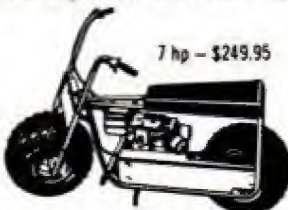
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APPLIANCE CLINIC

(Continued from page 58B)

mechanical ingenuity? First of all, are you sure the timer adjustment (that knob on the side of the toaster) hasn't been turned all the way over to the dark side? Has one of the kids been fooling around?

If the adjustment is okay, the problem probably lies with the thermostat contact points of the timer. They may be sticking. The unit should come apart. If points are bad, replace them.

Iceberg

I own a General Electric refrigerator, model TB 14 SDB, that is 3 years old. From the start, blocks of ice have formed on the refrigerator section cooling coils. This is most upsetting since this is supposed to be a self-defrosting unit. The problem is not being caused by bottles touching the coils. The cooling compartment is maintained at 37° F., and the freezer stays between 0° to minus 10° F. Can you tell me what's wrong?—Dennis A. DesRosiers, Willingboro, N.J.

The General Electric model TB14S is not a completely automatic defrost unit. The freezer compartment has to be manually defrosted. Automatic defrosting of the refrigerator fresh food compartment takes place when the refrigerator turns off. The "on" cycle of the temperature control is set so that the cooling coil is slightly above freezing temperature at the point of "turn on," permitting accumulated frost to melt. Two low-wattage heaters attached to the cooling coil are energized during the off cycle to assure complete defrosting of the coil. Possibly these heaters aren't operating, so I would consult an authorized G.E. serviceman.

First, though, check the possibility you are operating the refrigerator at an abnormally low temperature, which could cause ice to form. Normal temperatures are around 39° F. in the fresh food compartment and 0° to minus 5° F. in the freezer compartment. Consult the use and care instruction manual that came with the unit to determine how to adjust the temperature control. If you've misplaced this booklet, write the Refrigerator Products Marketing Dept., General Electric Co., Appliance Park, Louisville, Ky. 40225, for a new one.

If you have a question about any appliance, send it to Appliance Clinic, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. Sorry, but letters cannot be answered individually. However, problems of widest interest will be answered in this column.

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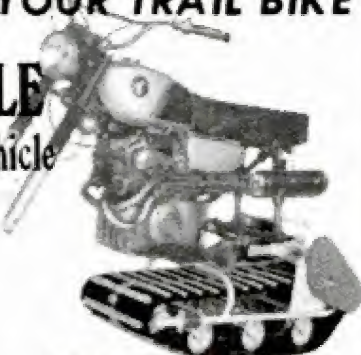
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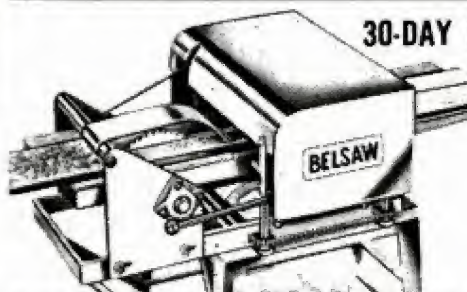
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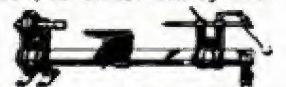
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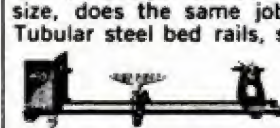
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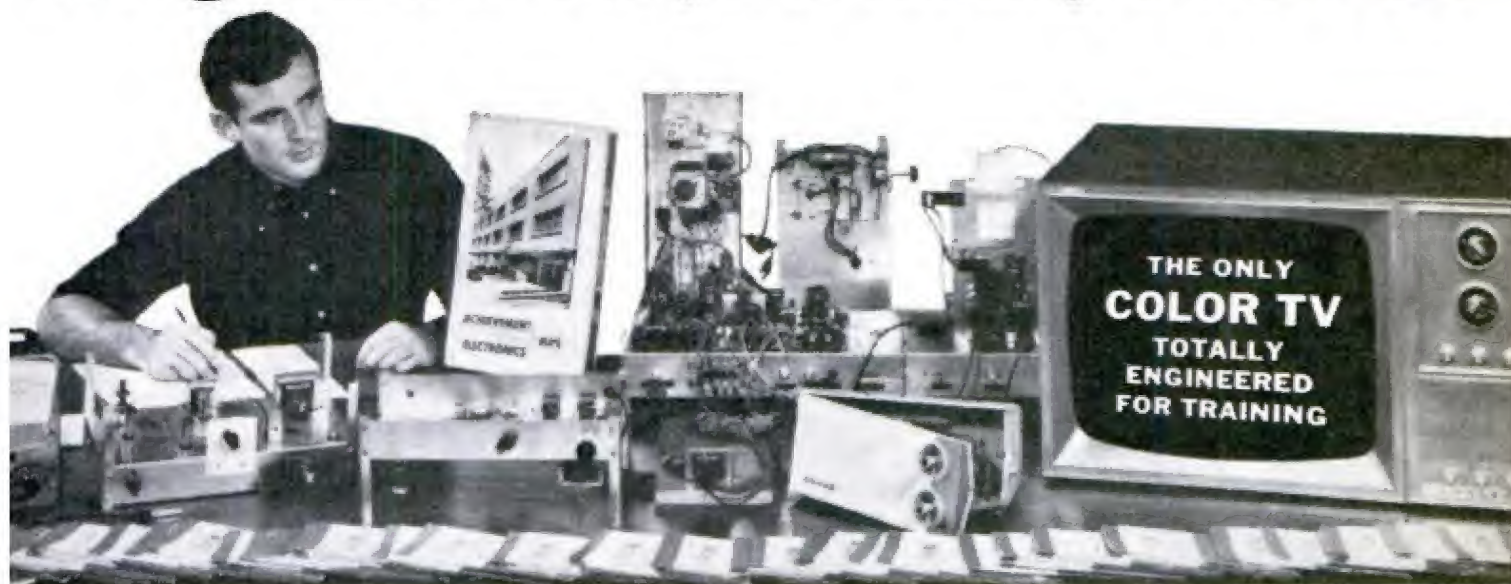
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HOMEOWNERS' CLINIC

BY W. CLYDE LAMMEY

Toothpick fillers for nail holes

I want to use two finely finished walnut boards in a home-shop project. Because they have a lot of small nail holes, all going clear through the wood, I'll need to stain the boards very lightly. How can I fill these holes so they won't show in the finish?—H.O., Cal.

You didn't say what kind of walnut—black, California, French, Circassian? All these varieties differ in texture, grain and color. While I think immediately of ordinary fillers or stick shellac, I once solved a similar problem by cutting short lengths from skewer toothpicks and driving them into the holes, just flush. Then I sanded the surface and tinted the lighter ends of the toothpick plugs to match the wood. When finished, the plugs showed only under very close examination.

When and how to seed a lawn

It's about time to think about what to do with my lawn. I don't know how long it's been in existence, but it's thinning and I'm told it needs to be renewed. How do I seed an existing lawn?—D.L., Mo.

Your lawn also needs, no doubt, to be renewed by a scheduled fertilization program, starting this coming spring. I've had good success by mixing grass seed with the fertilizer in the spreader: a layer of fertilizer, a layer of seed successively in the hopper, then hand mixing until both seed and fertilizer are uniformly distributed. Don't expect immediate results. You may see little improvement the first season other than that brought about by feeding existing plants. But if you follow through you will notice a thickening of the sod the second season.

Small areas with few or no plants should be spot-seeded by first working the top soil, spreading the seed and covering lightly. Keep these areas well watered.

What to do with lawn clippings

When I ask what to do with lawn clippings I get confusing answers. Some say leave them at each mowing; others say gather the clippings and compost them. What do you say?—P.G., N.J.

There are differences of opinion. Some authorities put it this way: If, after drying, you can see the clippings, then they should be gathered at each mowing and composted, along with leaves, garden refuse, and the like. I can go along with this procedure. On the other hand I was once told by a greenskeeper that "if you wait until your lawn appears to need mowing, you've already waited too long. Keep it clipped short, never less than 1½ in., excepting the bent grass, and don't gather the clippings."

I can see advantages in both procedures, mainly that in both instances the enriching and mulching elements present in the clippings are returned eventually to the soil.

Concrete patch didn't hold

Last summer I patched a step on my concrete stoop, a corner that broke away. It didn't hold; just fell out of place. I'd like to try again, as I don't want to replace the stoop. Can you tell me the right procedure?—C.T., R.I.

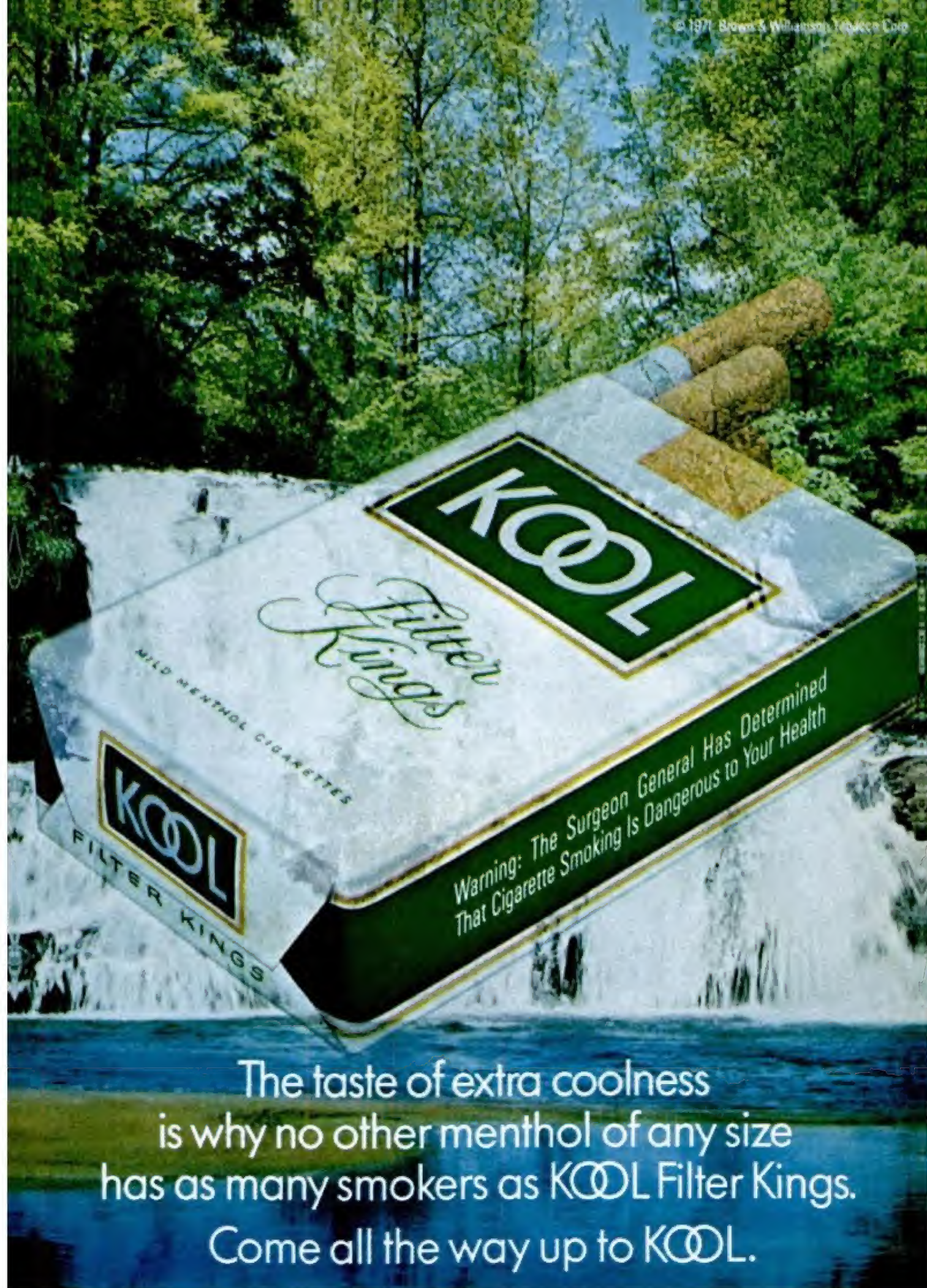
Did you use a concrete patcher especially prepared for the purpose? New concrete won't always bond to old, even though you may have cleaned out all dirt and loose material. Obtain a concrete-patching material which comes as a dry mix and add water in a measured proportion. Again clean the area to be patched thoroughly and make an L-shaped form, bracing or staking the form so it will stay in place until the concrete mix sets. When mixing, be sure to follow instructions on the container in all details. After troweling the mix in place, cover with burlap or coarse cloth and keep damp several days.

When to fertilize trees and shrubs

I think it best to fertilize ornamental trees and shrubs in spring, but I'm told that fall is best. Am I right?—O.D., Md.

You've answered your question. I agree that spring is usually, if not always, the best time to feed trees and shrubs, especially if the soil is a loose, sandy or gravelly loam. If you apply plant food to such soils in the fall, some of it is sure to be lost to the plant by leaching to levels below the root systems. In heavier soils it may be permissible to feed in the fall, but I'd rather rely on early spring. ★★ ★

Do you have a home maintenance or repair problem? Send it to Homeowners' Clinic, Popular Mechanics, 224 West 57th St., New York, N.Y. 10019. While letters cannot be answered individually, problems of wide interest will be discussed in this column.



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You don't have to move to get a new home

High interest rates, commuting, the desire to stay where you are: These are all good reasons for improving instead of moving

By **HARRY WICKS**, Workshop Editor

*Data, Annette Sukov
Photos by Dean Paris*

SKETCH shows the original porch that was enlarged to 16 by 30 feet to yield family room and larger kitchen



TODAY, ADDING TO OR REMODELING your home, rather than searching for a newer, larger house, is often the wiser choice for a homeowner. Depending upon size and selection of finishing materials, it is almost certain to be the less expensive approach—particularly if your own mortgage interest rate is well below the eight (or more) percent most banks are now charging.

Money isn't the only factor. Most of us like where we live, and if you have youngsters in school, a family shift will require more than a few adjustments.



Since the property that this Minneapolis family owned would permit them to build the room they needed, their decision was to stay put and add on. They also increased their living area by adding a lighted patio. And, since the original house was due for a re-roofing, the entire house was covered with hand-split cedar shakes.

The vaulted ceiling is simply ½-in.-thick plasterboard over 2x6 collar beams. To finish, the plasterboard was heavily textured with paint and the joints covered with decorative oak beams.

For general use, the lighting concealed behind the wood soffit close to the ceiling gives sufficient illumination. It consists of fluorescent strips which reflect off the painted ceiling. For decorative appeal, oak dentil molding was used around the room where walls and ceiling meet.

The original heating plant was capable of handling the new room; thus, it was not necessary to install new heating equipment. But the builder did relocate the thermostat, placing it in the new room. The single thermostat handles the entire house adequately from this location.

Desiring overall, even lighting, rather than one or two ceiling fixtures, the homeowner chose a luminous ceiling for the kitchen. (See *Luminous ceilings—shadowless and beautiful*, page 116 Jan. PM). Even here, the owner decided to "customize." The plastic, which comes in 2x4-ft. sheets, was halved to create 2x2-ft. sections. Installation was standard using the metal grid system. For visual tie-in with the family room, simulated beams were spaced at intervals across the ceiling.

The kitchen cabinets, custom-made, are also of oak. As seen in the photos and floor plan, strategically placed accordion doors can be kept open for general everyday use or closed when

CAREFULLY PLANNED ADDITION has bypassing doors located to give best view of the outdoors. Fireplace is built of kasota stone and has an oak mantel







ENLARGED KITCHEN features a luminous ceiling. Oak beams were added for a visual tie-in with the new room. The cabinets are also of oak, and a suede-finish, white plastic laminate was used on the countertop

desired. They were placed at the peninsula counter so that area can be left open and used as a pass-through when wanted.

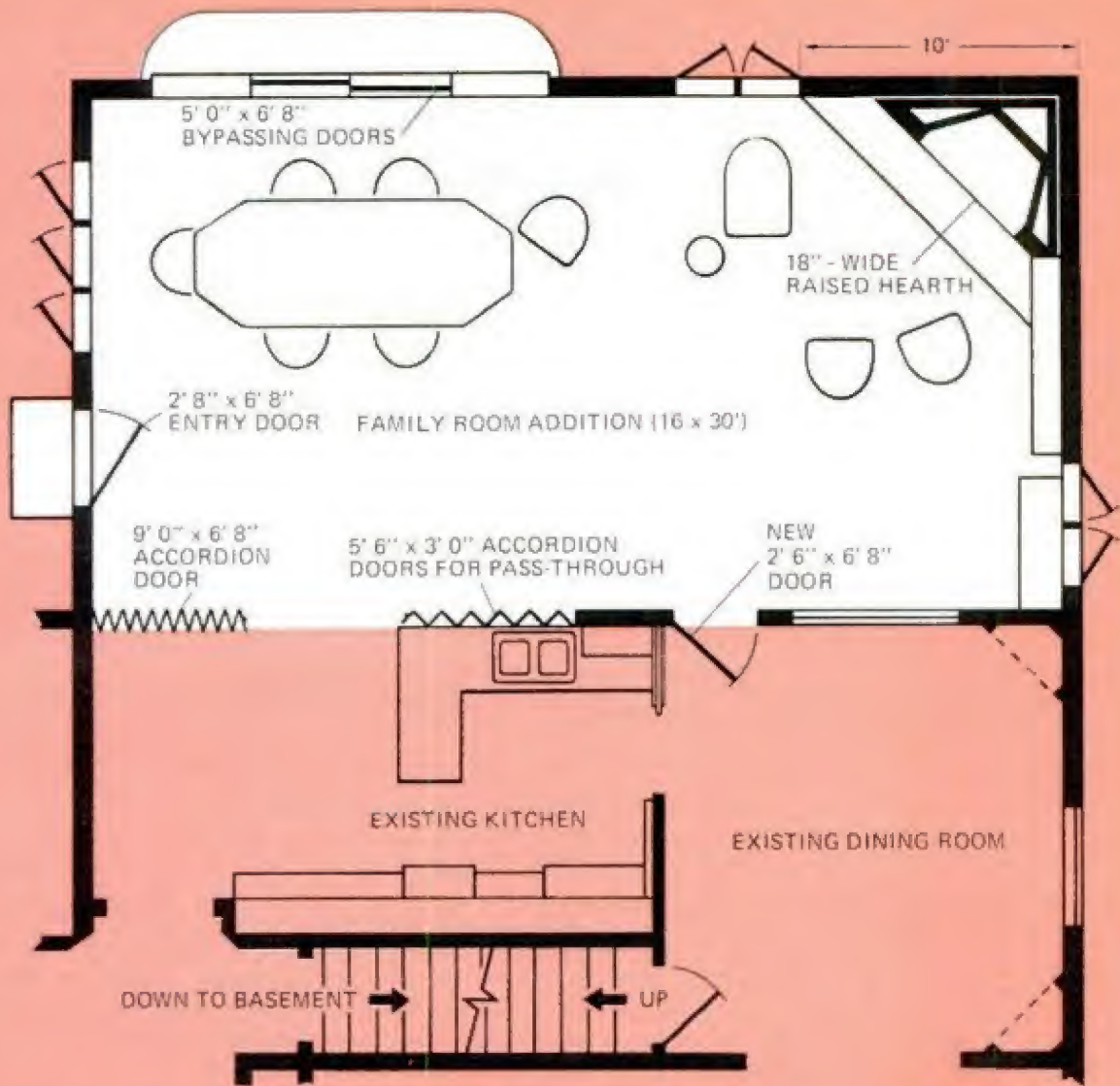
The brick-patterned vinyl flooring was picked up from the old kitchen and relaid.

To make the step platform by the sliding doors, slate was simply embedded in concrete. The concrete patio has a smooth steel-trowel finish and raked lines radiating from the platform. The outdoor lighting was solved by simply setting a plastic globe on steel pipe, which, of course, is erected in a footing.

What makes this addition particular-

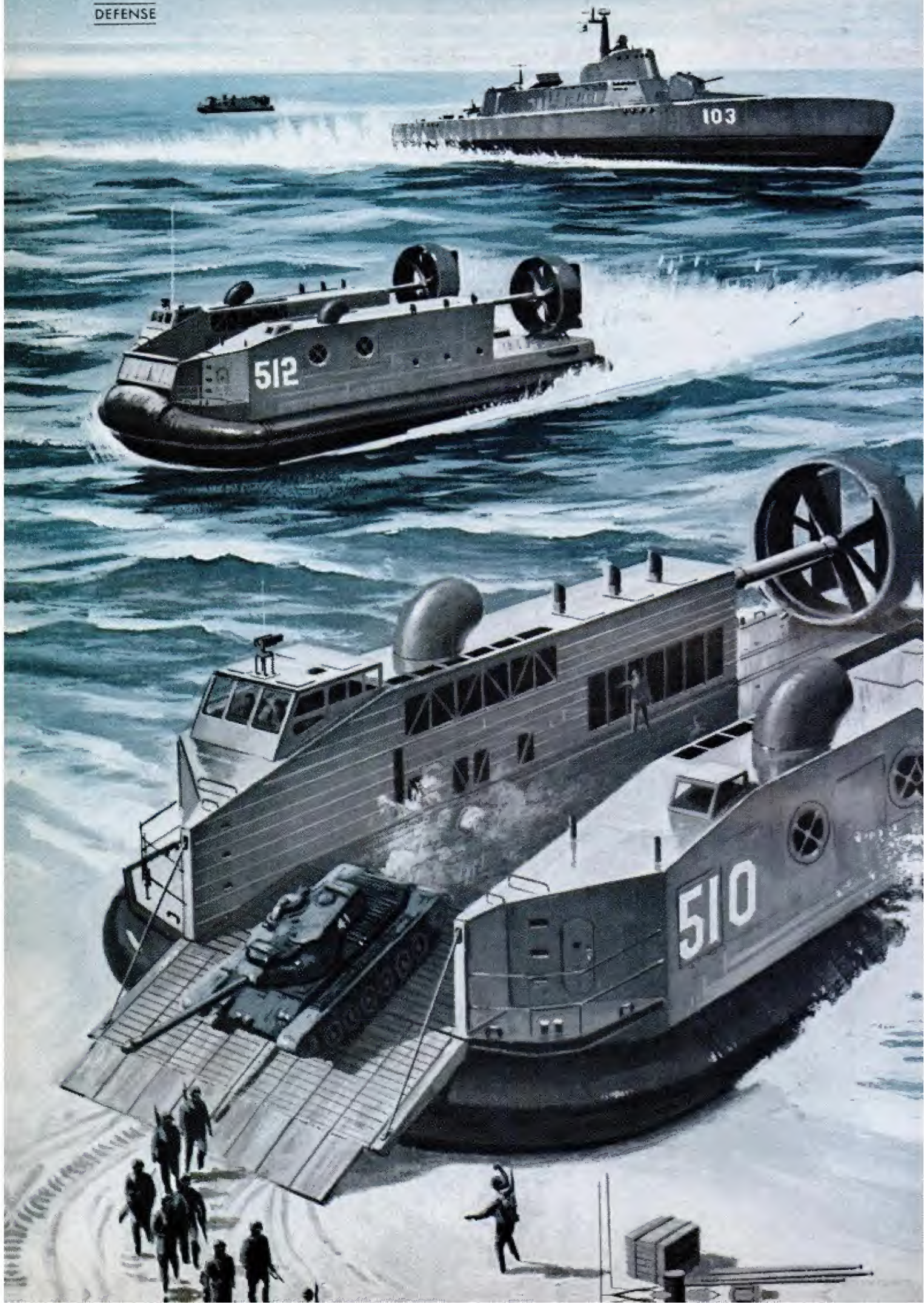
ly attractive is continuity of design, both indoors and out. It is obvious that the homeowner and builder worked closely together on the project and it shows in the finished product. The new hip roof ties in perfectly with the existing house roofline. And that is important. A poorly or hastily conceived addition will almost always result in a structure that has a tacked-on look. This is something to avoid if you want to add to, rather than detract from, the value of your home.


It might even pay to have an architect look at your home and make suggestions so that you will avoid this common pitfall. ★★★



ACCORDION DOORS are used when it is desirable to hide the kitchen from view. The floor plan shows how careful planning insured that this addition would become a part of the home and not look tacked on







A fast fleet that rides on **AIR**

Warfare on the high seas will never be the same if Navy's revolutionary plan to launch 100-knot ships is successful

By MORT SCHULTZ

TO MEET the seagoing challenges of the 1980s, the Navy is developing an armada of small vessels able to ride on a cushion of air while doing 100 knots—a speed conventional ships can never hope to equal.

The Navy calls them surface-effect ships (SES), and foresees the day when they will swiftly hunt down and destroy nuclear submarines, act as fast-moving missile launching platforms, or safely haul cargo and troops from a mother ship to an inland point after hopping over the beach.

In asking for \$40-million this fiscal year to push the SES project, Rear Adm. William H. Livingston, director of the Navy's Air, Surface and Electronics Warfare Div., told Congress that "almost all Navy missions can be

enhanced by surface-effect ships. They can go faster."

Conventional ships waste a large portion of their power simply pushing water out of the way, particularly at high speeds. A streamlined destroyer, for example, can make 27 knots with 15,000 hp. Doubling the horsepower doesn't help that much; the ship reaches only 32 knots.

SESSs, however, use the additional power to rise above the water, reducing or eliminating hull drag while substantially improving their speed.

Right now, the Navy brass is keeping an eye on two SES types being developed by Bell Aerospace Co. and Aerojet-General Corp. One craft "flies" over the water on a cushion of air. The other uses an air bubble to lift the front of the hull above the waves, leaving two thin sidewalls in the aft section extending several feet below the waterline to add stability and prevent skidding during turns.

The two aerospace outfits are building slightly different 100-ton prototypes of the air-bubble vessel—scale models of transoceanic ships weighing 4000 to 5000 tons, the approximate size of a destroyer escort.

Bell's version, SES-100B, a 77-foot-long, 35-foot-wide aluminum craft, rides on a cushion of air trapped by catamaran-style side hulls and flexible nylon-rubber bow and stern seals. The air is generated by eight lift fans driven by three 500-hp ST6J-70 marine gas turbine engines made by United Aircraft of Canada.

When cruising, the bow and center portion of the hull clears the water,



HULL STRUCTURE of Bell Aerospace's 100-ton prototype surface-effect ship is completely aluminum

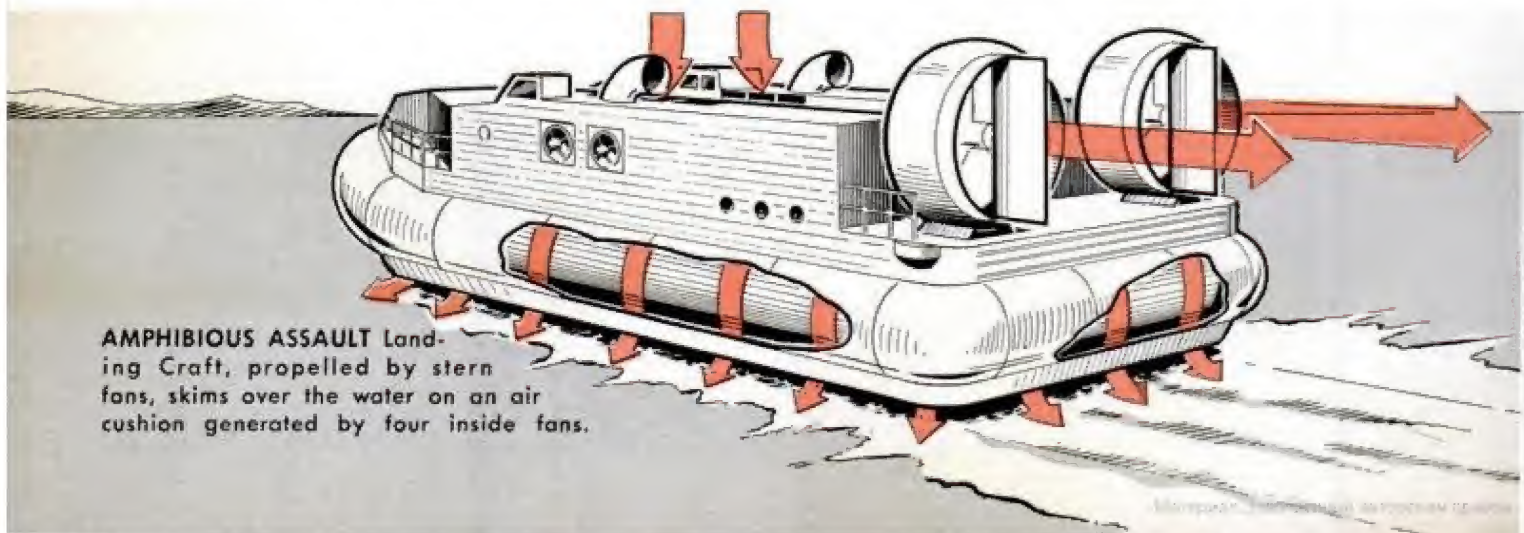
entirely supported by the trapped air bubble.

Propulsion comes from three Pratt & Whitney 4500-hp FT12A-6 marine gas turbines that drive two semisubmerged, controllable-pitch, supercavitating propellers in the stern.

Trial runs of the Bell midget carrying a crew of four, six observers and a 10-ton payload are being held this year in the Gulf of Mexico to determine if the craft can be routinely pushed to 80 knots. If that speed is easily reached, engineers will try for 100 knots.

Aerojet-General's pioneer will be slightly longer than the Bell version—80.5 feet long, and 38 feet wide—but more significant is the difference in propulsion. Instead of semisubmerged props, the Aerojet-General SES-100A has a propulsion system that uses two powerful water-jet pumps. Both pumps and the three lift fans get their juice from four 3500-hp gas turbines.

If the SES prototypes prove them-



AMPHIBIOUS ASSAULT Landing Craft, propelled by stern fans, skims over the water on an air cushion generated by four inside fans.



LANDING CRAFT (shown in a full-scale mock-up) designed to carry a 60-ton tank plus fighting men

selves, it's likely the first application will be SES antisubmarine vessels. A full-grown 100-knot SES would be much faster than the nuclear submarines that now outrun today's 40-knot subchasers, and would be able to twist and turn tightly, thanks to their underwater sea legs. They'd also be less vulnerable to enemy sub sonar and wouldn't present much of a torpedo target because only a small portion of their hull is in the sea.

In the rush to develop 100-knot SESs, the Navy hasn't forgotten a primary mission—landing troops and their back-up cargo on an invasion beach. Bell and Aerojet-General have contracts to work out two amphibious assault landing craft, nicknamed JEFFs.

The boats, designated C150-50, are based on the Navy's combat experience in Vietnam in 1966 and 1967 when 10 air-cushion patrol vehicles were tried out (see *'Tiger Sharks' strike in the Vietnam swamps*, page 131, Nov. '67 PM). Called hovercraft, the vessels

were awkward-looking, small pancakes 39 feet long, 24 feet wide, and powered by a single 1150-hp General Electric gas turbine that sent them skimming four feet above the Delta at 60 knots.

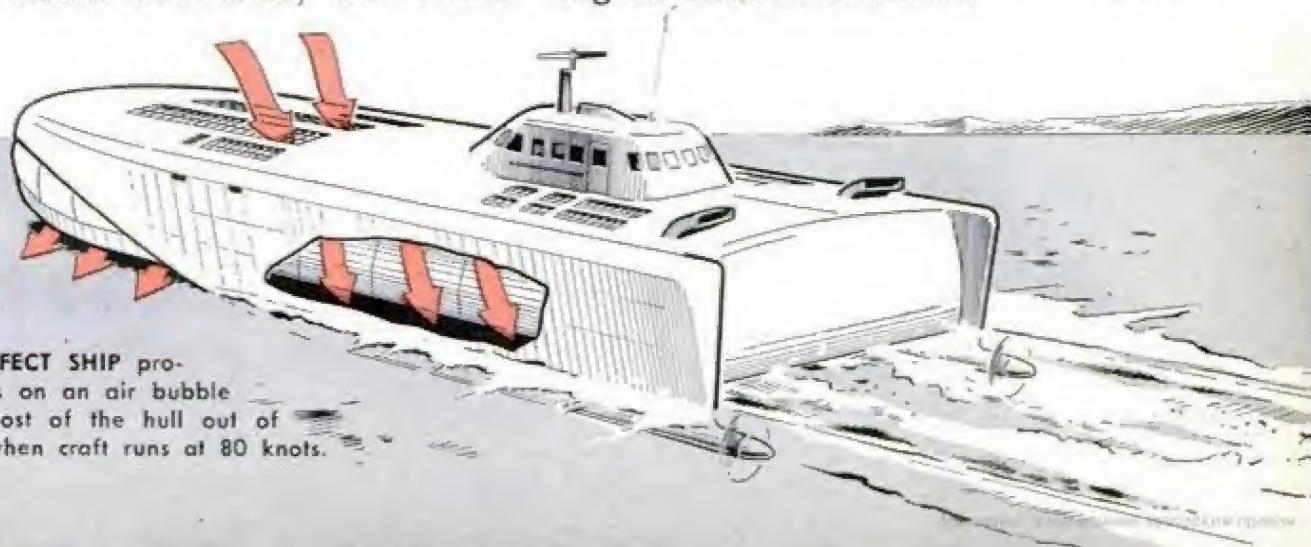
Today's JEFF has come a long way from those early experiments. Bell's prototype calls for a craft 90 feet long and 47 feet wide, able to carry 75 tons of cargo above the water or beach while riding completely on a cushion of air. Top speed: 50 knots, or five times faster than the assault boats that hit the beach at Normandy.

Six 2800-hp marine gas turbines will drive a pair of 14-foot diameter propellers mounted above the stern to push the boat while four five-foot fans on the sides maintain the air cushion.

The Navy will run boats from mother ships able to stand 200 miles off the invasion beach, safely out of range of crippling shore batteries. While JEFFs won't be as fast as the early hovercraft, they'll carry much more cargo—vital when supporting an invasion.

These SES projects make up the giant portion of the Navy's small ship program. Other projects include a \$12.9-million program for hydrofoil experiments plus \$3-million for work on "sea control" ships—small seagoing platforms able to launch helicopters and short takeoff jet attack aircraft.

But the lion's share is going to SES projects. Reason: A report to the Pentagon by the Institute of Defense Analysis concluded that "the principle of air-cushion vehicles appears to offer more potential for naval military surface vehicles than any other development during the last two centuries." ★ ★ ★



SURFACE-EFFECT SHIP prototype rides on an air bubble that lifts most of the hull out of the water when craft runs at 80 knots.

PM FIAT 124 OWNERS REPORT...

A nationwide survey based on
1,700,000 owner-
driven miles

It's a car for all seasons but owners yearn for more power



By MICHAEL LAMM,
West Coast Editor

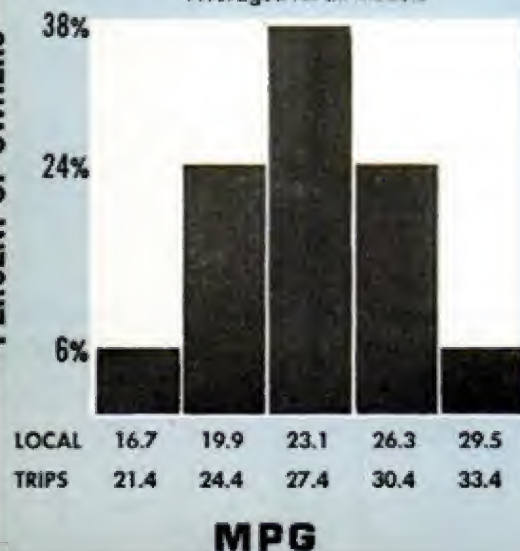
Photos by the author

F IAT LUMPS THEM all together simply as 124s, but there's as much difference between the two sport versions and the family models as between Ford's Mustang and the Galaxie 500.

Two basic body types in four models make up the Fiat 124 line: a sport convertible (Spider), Sport Coupe, a four-door sedan and four-door wagon. The Spider and coupe look almost like twins and so do the sedan and wagon, but neither set resembles the other. Spider and coupe are low and pointed; sedan and wagon stand tall and square.

Fiat's 124 sportsters share a 104-hp double-overhead-cam Four, and this same basic block also powers the 124 family cars. But in the sedan and wagon Fiat tops off the engine with overhead

FIAT FUEL-MILEAGE CHART
Averaged for all models



valves, not double overhead cams, the result being 28 fewer horses. For other differences and similarities, check the specifications chart on page 74.

To give our Fiat 124 *Owners Report* more validity, we'll separate the opinions of sport-model owners from those who drive the family versions. We'll begin by listing comments for the Spider and Sport Coupe.

"Brakes are the best I've ever felt," says a Sacramento graphic artist. They're four-wheel discs and give excellent fade resistance and stopping power. This same braking system is used on all Fiat 124s.

"Fifth gear is tremendous for long trips," comments a San Antonio metal-smith. Both the Spider and Sport Coupe come with five-speed transmission as standard equipment. High is an overdrive ratio at 0.91:1 (fourth is 1.1).

"The Spider is a beautiful driving experience . . .," writes a Connecticut marketing vice president, "... with the small-sports-car handling I had hoped for. On the open highway the automobile is smooth and responsive. Trips over winding country roads are a popular pastime with the Spider. Each member of the family enjoys it very much." Most owners did say good things about the Fiats' handling. Suspension systems on all 124s use four-wheel coils, with a solid rear axle. Fiats boast stabilizer bars fore and aft and come with radial tires.

"Excellent workmanship—built with an accent on safety because of its solid, sturdy design and construction." So affirms a New York secretary. Fiats use unitized bodies; no separate frames.

"Seat height should be lowered so the steering wheel position can be changed by tilting it down more," opines a Michigan ad copywriter. Yet most owners do find the front buckets very comfortable. This is one of the few cars in its class with a rear bench. Although the back seat tends to be cramped, most owners anticipated this and don't consider it a drawback. It's fine for kids and even an occasional

FEBRUARY 1972



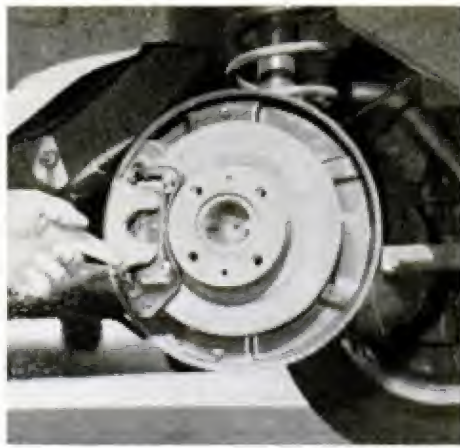
SEDAN AND WAGON use familiar overhead valves in four-cylinder engine; sports models, overhead cams



SEDAN TRUNK pleased almost all owners. Sedan and wagon have breadbox lines for good space utilization



124 ECONOMY was big buying factor for sedan and wagon owners, but then they found fun of handling



DISC BRAKES on all four wheels were praised by owners of all 124 models



DRIVING POSITION, COMFORT got fine ratings from sedan owners, even more enthusiastic comments from Spider and Coupe owners



JACK SLOTS on sides are positive and secure as on most imported cars



EXHAUST VENTS in the C-pillar are for a flow-through ventilation system

short-hop adult, so its presence is generally appreciated.

"Would like a V6 put into the American version," suggests a Nebraska budget analyst. "About 50 more horsepower would be nice," echoes a Florida attorney. "Could use a higher fifth gear and a 2000-cc engine," is the way a Washington dentist sees it. And a Los Angeles writer writes: "I hate to admit it, but I'd like a bigger dohc engine; 1600-cc just isn't enough in present fast company, namely the Datsun 240-Z. Fiat's mid-range power curve and gearing are wrong for the city." Some 14 percent of all Fiat owners say they'd appreciate more oomph.

Asked if they'd had mechanical troubles, 55.3 percent said yes—a rather high incidence. Most persistent were electrical ills. Quite a number of Spider and Sport Coupe owners said that the engine drowned out easily after driving through puddles. Several mentioned that the windshield wipers worked fine until it rained; then, in the wet, the wiper motors wouldn't budge, most likely because of shorts.

A significant number also complained of noises from the exhaust manifold and from the speedometer cable. Six percent noted they'd had transmission trouble, most saying the gearbox was hard to shift into reverse. A few of the Spiders

FIAT 124 SPECIFICATIONS

| Model | Type of Engine | Displacement | Bhp & Torque @ Rpm | Transmission | Wheelbase (in.) | Dry Weight (lbs.) |
|---------------|----------------|-------------------------|---------------------|-----------------------------|-----------------|-------------------|
| Spider | dohc 4 | 1608 cc 96.5 cu. in. | 104@6500 94@4200 | 5-speed manual | 89.8 | 2046 |
| Sport Coupe | dohc 4 | 1608 cc 96.5 cu. in. | 104@6500 94@4200 | 5-speed manual | 95.3 | 2110 |
| Sedan Special | ohv 4 | 1438 cc 87.8 cu. in. | 76@5400 81@3300 | 4-speed manual or automatic | 95.3 | 2085 |
| Wagon | ohv 4 | 1438 cc 87.8 cu. in. | 76@5400 81@3300 | 4-speed manual or automatic | 95.3 | 2084 |



124 SPORT SPIDER is an enthusiasts' car chosen by owners for its style and handling. Despite the good performance of the new 1608-cc, dohc engine, many owners would like to see a still larger engine, more power

and Sport Coupes suffered from broken gear cogs, and the factory warranty specifically excludes these teeth from coverage. Dealers usually warn enthusiastic new owners not to speed shift or drag-race the 124.

Moving along now to the sedan and wagon—owners had these remarks:

"I was apprehensive about dealer service when I first bought the car," says a New York planning consultant, "but I find my dealer excellent in every way." Most Fiat owners do, a few saying they'd like to see a larger dealer network and shorter waits for parts. "Very good dealer relations here," writes a California plastics fabricator, "except the free service at 1000 and 2500 miles cost me \$3 and \$4.50."

"I am most impressed by the big-car feel, yet my sedan handles and parks like a small one," states a North Carolina lab administrator. And a Kansas student: "I am amazed at the amount of room the trunk contains. Once we had four suitcases, three sleeping bags, a trumpet case, and a guitar case in the trunk and still had room for odds and ends."

Again, owners of the sedan and wagon lavish great praise on their cars' handling, maneuverability, stopping and steering. All 124s use the same systems, so in effect you get the genuine sports car basics, even in the wagon. Quite a number of sedan and wagon owners mentioned that cross-

(Please turn to page 118)

Summary of 1971 Fiat 124 Owners Reports*

Total miles driven1,734,351

Average miles per gallon

Local driving23.1
Long trips27.4

Body styles

124 Spider convertible40.3%
124 coupe30.3
124 Sedan Special21.7
124 station wagon7.7

Why the Fiat 124?

Styling35.4%
Economy23.0
Price21.1
Handling17.4
Reports and ads14.0
Size9.3
Performance8.7

Specific likes:

Handling67.0%
Economy43.7
Style43.7
Comfort36.1
Performance17.9
Brakes17.6
Power12.6
Ride12.3

Specific dislikes:

Rattles11.9%
Dealer service11.1
Quality of materials9.9
Cold starts7.7
Lack of power7.7
Brake squeal7.4
Radio6.5
Poor workmanship6.3

What changes would you like?

More power13.8%
Better materials11.3
Bigger engine8.5
Better seat comfort6.3
Less slippery steering
wheel5.4
Headlight dimmer on floor5.0

Had any mechanical trouble?

Yes55.3%
No44.7

What kind of trouble?

Electrical17.1%
Exhaust manifold11.6
Speedometer cable9.6
Brakes9.1
Windshield wipers8.5
Carburetor6.0
Transmission6.0

Did you repair it yourself?

No91.3%
Yes8.7

Dealer repairs satisfactory?

Yes65.5%
No34.5

Is the Fiat your only car?

No57.2%
Yes42.8

Other cars owned:

Chevrolet18.2%
Volkswagen14.3
Ford11.8
Oldsmobile8.9
Pontiac8.9
Buick8.4
Fiat7.4
Dodge6.4

Age distribution of owners?

15-29 years56.4%
30-49 years31.5
50-plus12.1

Would you buy another Fiat?

Yes83.2%
No16.8

*Percentages might not equal 100% due to rounding and/or insufficient data.

IN AN ERA when most people are familiar with how men get to the moon, the blimp remains an enigma.

A teen-ager, after recently watching a blimp float majestically over New York City, asked how the "big balloon" got there, and if it carried people. In California, a would-be hijacker demanded a blimp crew fly him to Colorado. He dropped the idea when told the craft would never climb high enough to clear the 11,000-foot peaks of the Rocky Mountains.

Even experienced pilots are puzzled by the slow-moving, silver-colored, flying sausages. "When we're out for a ride," says Joe Hajack, a pilot for Goodyear Tire and Rubber Co.'s blimp squadron, "we attract every private plane in the sky. They try to fly alongside or circle around us. Either way, they can't win.

"We cruise at 25 miles an hour, and there aren't many planes that can go that slow without stalling. When they try to circle us, they're out of luck again because my blimp can turn on a dime. As the plane circles me, I turn the blimp. Everytime the pilot looks at us, our nose is pointed at him."

Hajack is one of 15 pilots who fly Goodyear's three blimps—the world's only operating fleet of lighter-than-air ships. He was recruited from the

IN THE BAG, employees (right) complete building Goodyear's 300th blimp, to be launched this summer

USING WHEEL, pilot (bottom right) adjusts blimp altitude by changing trim of elevators on the tail

GROUND CREWMEN must pull airship via dangling lines (bottom) into the wind before blimp takes off

Up, up and away! Very slowly

By DIANA and
HARVEY SHAMAN





VALVE releases air as the blimp rises, allowing more space for expanding helium

ON GROUND, blower is required to maintain proper pressure in ship's air bags

Navy after it abandoned blimps in 1962.

The lighter-than-air ship, at times called a dirigible or zeppelin, goes back to 1852 when the first power-driven airship successfully flew above Paris. The ungainly craft's golden age began in 1900 when the first zeppelin, a hydrogen-filled balloon with a rigid internal frame made of aluminum, was launched in Germany.

World War I spurred development, especially in Germany which used zeppelins to bomb England. Further research after the war produced the

Graf Zeppelin for commercial transatlantic service in 1928. The huge ship made 144 crossings before being retired after nine years. A sister airship, *Hindenburg*, was launched in 1936, but crashed one year later when her flammable hydrogen gas exploded while she was landing in New Jersey, killing 36 persons aboard.

The U.S. Navy had two large rigid airships between the world wars, but the *Akron* crashed in 1933, and the *Macon* went down in 1935, causing officers to reduce large-scale airship

operations. Blimps were revived for coastal patrol in World War II, and by 1945 the Navy had a fleet of 168.

The Navy kept a few flying until improvements in electronics and aircraft eliminated their usefulness, leaving the skies to the Goodyear blimps.

The company's sisterships *America* and *Columbia*, both built in 1969, are 192 feet long, 59 feet high, and 50 feet wide. The *Mayflower*, commissioned in 1968, is slightly smaller. The trio can each carry six passengers and a pilot in a car slung under the bag. The gas bag is filled with helium, but does not have a metal supporting skeleton inside as did the zeppelins. Gas pressure keeps the walls rigid.

Although able to do 50 mph, the flying Goodyear billboards average a placid 25 to 35 mph while cruising comfortably at 1000 to 3000-foot altitudes. Maximum ceiling is 7500 feet, but pilots seldom go that high since people on the ground wouldn't be able to read the company's name splashed the length of the ship. Advertising is the fleet's purpose.

Each blimp is assigned five pilots plus 12 to 16 ground crewmen who help during takeoffs, landings, and moorings plus doubling as mechanics, riggers and radio technicians.

At takeoff, the ground crew grabs

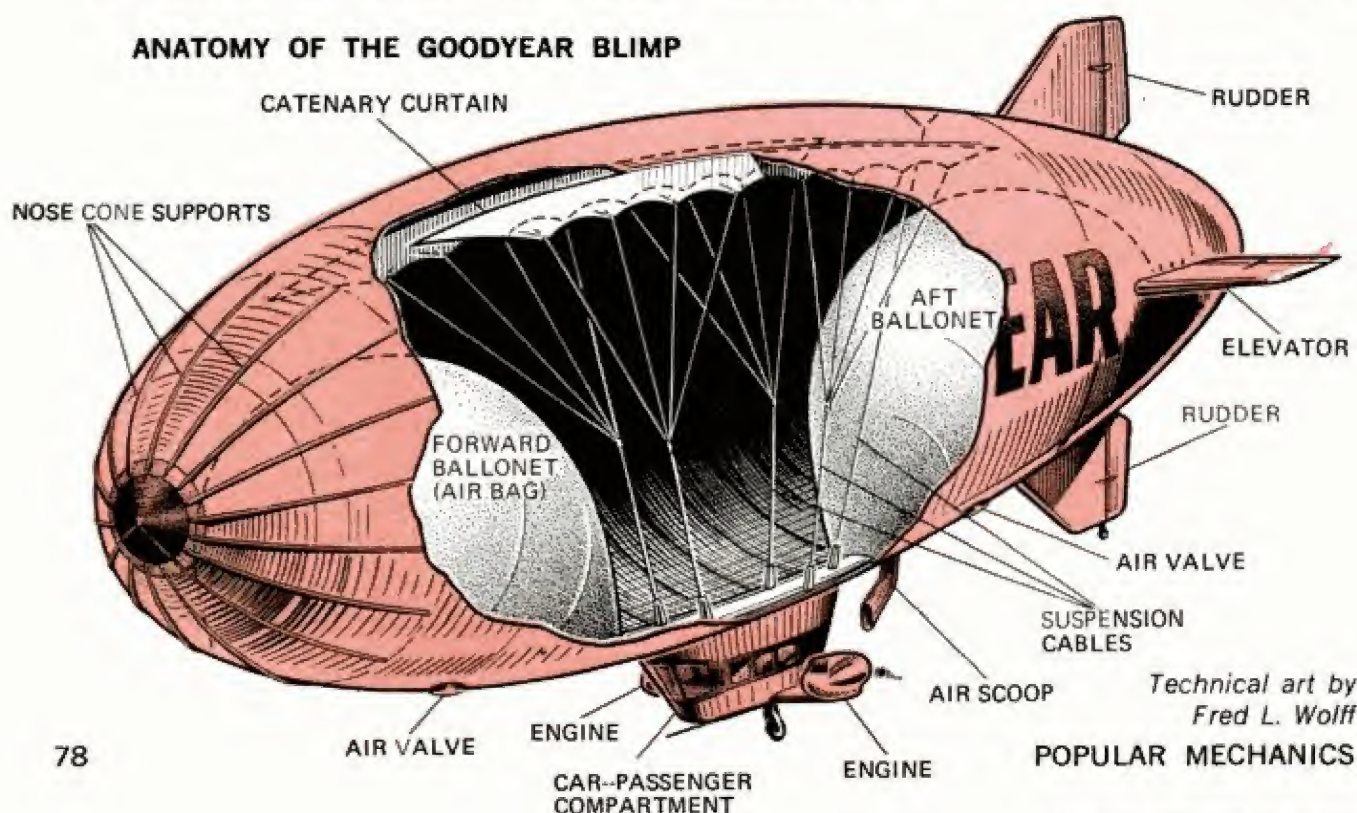
ropes dangling from the blimp, and walks the craft downwind to the end of the field, then swings the nose into the wind. The pilot revs up the twin 210-hp, six-cylinder aircraft engines, and taxis down the runway on a single swiveling wheel attached to the gondola's underbelly. When the blimp is going fast enough to develop lift, the pilot raises the blunt nose, and the ship is airborne.

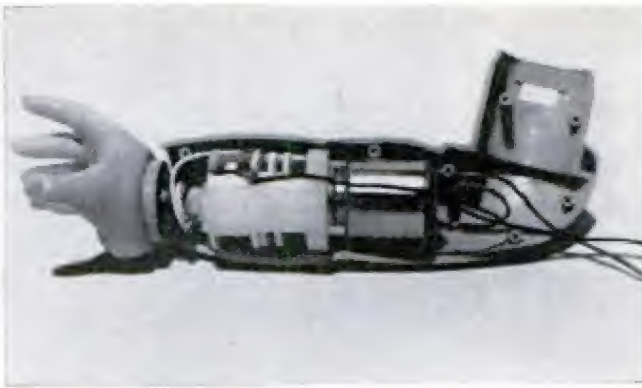
To land, the pilot points the airship downward into the wind, and eases it into the open end of a "V" formed by the ground crew, and cuts the engine. The crew grabs the lines, holding the blimp down until it is moored.

Navigation is line-of-sight with pilots following a highway, railroad track or river. Flying is limited to clear days when ground winds do not go over 15 to 20 mph.

The ponderous blimp may be an aviation anachronism in a time when men routinely fly faster than the speed of sound, but not at Goodyear. The company that pioneered blimp development in the United States, is currently constructing a fourth modern airship, the 300th to be built by Goodyear, which will be christened *Europa*. After assembly in England this summer, the ship will be stationed permanently in Europe. ★★★

ANATOMY OF THE GOODYEAR BLIMP





Dice-rolling dolly

Here's one solution for children bored during a rainy day: Lucky Lisa, a doll able to "throw" dice. The doll plays after her right arm is extended parallel to the surface she is sitting on, and the dice are dropped into her cup. The doll shakes the dice, then tosses them on the table. Behind Lucky Lisa's roll is a battery-powered motor hidden in her right arm (above). The motor uses six sets of spur-tooth gears to give the arm a lifelike motion when it is shaking and tipping the cup. Lisa is manufactured in Great Britain.



S-curved bridge

German road builders erected this curving bridge over the Autobahn near Hannover, contending it will be stronger than a straight span while costing the same to construct. Because drivers must slow their cars when crossing, fewer weakening vibrations will be sent down through the concrete structure.



Government collects gripes

Amsterdam citizens with a gripe or a suggestion about their local government can put them in "ideeën" (idea) boxes placed around the Dutch city. Messages are picked up daily and delivered to a government agent who forwards good ones to the appropriate city department. In one year, officials considered 127 out of 200 submitted, and adopted 11.

NEWS BRIEFS



Driver's license by computer

Rather than ask a person to drive a real car before issuing a license, Washington state examiners sit an applicant in an auto simulator and flash emergency scenes in front of him on a movie screen (top). A computer scores the applicant's reaction. The written test is taken with a computer keyboard and a small screen displays questions (left); the applicant simply hits a button to answer. One instructor can give 16 tests per hour.



Tallest gravity dam

When the Army Corps of Engineers completes construction this year, the Dworshak Dam in northern Idaho will be the highest straight-axis concrete gravity dam in the Western Hemisphere. To build the 549-foot wall across the Clearwater River's north fork, engineers dug the world's second deepest rock quarry—480 feet. The crushed rock was used in the 6.5 million cubic yards of concrete for the dam.



Secretary's cradle

As a step toward the paperless office, a German designer has come up with this self-contained "office" that includes chair, desk and typewriter. The secretary can receive information through terminals at her ears, or from a computer readout. The typewriter can be replaced by a telex machine, microfilm reading equipment, or a computer terminal. This futuristic arrangement cost \$20,000 to make.



Vintage-car decor

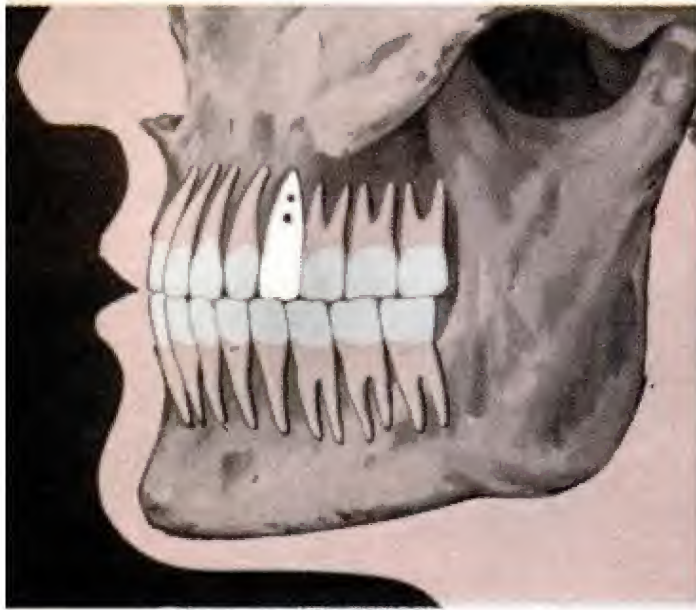
When not restoring vintage Morgan sports cars (upper left), English engineer Jack Brown turns to redecorating his home with antique auto parts. He has replaced his living-room fireplace with distinctive headlights and grille from an old Rolls-Royce (left) and added a dining room chandelier (above) made from connecting rods and pistons of an old Lancia.



Railroad empire builder

Sixty-three locomotives, plus passenger and freight cars, run on this British model railroad that Victor Martin (left) and his wife spent 20 years hand-making in their garden shed. The trains travel on 3000 feet of track laid over 24,000 ties imbedded in fine gravel. A 12-volt d.c. system powered by old railroad batteries supplies electricity.

Plastic teeth that



POP-IN TOOTH WAS IMPLANTED in a patient's upper jaw (drawing) following an extraction. Two years later, an examination revealed that healthy gum tissue had surrounded the acrylic replacement (arrow)

IF YOU'VE EVER LOST a permanent tooth, you may know how expensive and uncomfortable a false one can be. The removable plate or fixed bridge holding the tooth is apt to be awkward, not very tasty, and may occasionally slip out of position.

But help is on the way. Dentists are successfully experimenting with a

permanent implant that "fools" the body into locking a false tooth to the jaw through new bone and tissue growth, thereby eliminating the need for a bridge or plate.

The regeneration of bone and tissue is what really excites dental researchers. The jawbone tends to recede when a tooth is pulled or when gums become diseased. Until relatively recently, dentists believed that the "lost" bone was never regained. Now the implants—in contrast with the effect of a bridge or plate—seem to trigger the regeneration of bone.

Dr. Arthur Ashman, a research dentist at Columbia University, has come up with one version of a single tooth implant formed with acrylic, a plastic resin found in everyday items from clothes to plexiglass. Following experiments with dogs, Ashman has implanted single false teeth in 15 patients who have worn them for more than four years without complaint.

After pulling a damaged tooth using routine dental techniques, Ashman forms the acrylic replacement in a mold on the spot. But rather than at-



SINGLE FALSE TOOTH (arrow) is held tightly in place by wires and acrylic resin after the insertion

'take root'

MEDICINE

By ARTHUR S. FREESE

Technical Illustration by Roy Grinnell

tach the replica to a plate or bridge, he drills one or two holes in the plastic "root," then pops the replacement into the space that was left by the pulled tooth.

The acrylic tooth is wired to an adjacent natural one, and the wire covered with acrylic. The wire acts as an anchor, holding the false tooth firmly until bone grows through the "root" holes, and gum tissue tightly surrounds it. The two permanently bond the false tooth to the jaw.

Dr. Ashman's pop-in tooth is much easier to install than a conventional bridge since a patient does not have to return to his office for repeated fittings, and it is cheaper because gold and silver are not used.

To further his research, Ashman recently teamed up with Dr. Milton Hodosh, a Tufts University dental professor who has also been experimenting with pop-in teeth, but on baboons. Hodosh, however, has concentrated on growing new gum tissue around and into an implanted tooth as well as stimulating new jawbone growth.

From their combined previous studies, the two hope to learn why the body will accept an acrylic tooth that keeps the jawbone from receding.

And, having grown bone horizontally, either through "root" holes or tiny porous openings produced with chemicals, Hodosh and Ashman will try to induce bone growth vertically. If successful, the technique would help persons suffering from gum diseases that weaken the jawbone structure holding teeth.

Today, Hodosh and Ashman are confining most of their new work to laboratory animals. But their future research could make dental gold and silver "old-fashioned," and plates and bridges as obsolete as the buggy whip—all with acrylic pop-in teeth.

★ ★ ★

FEBRUARY 1972



PLASTER MOLD OF TOOTH is made immediately after extraction. Mold is used to form acrylic replica

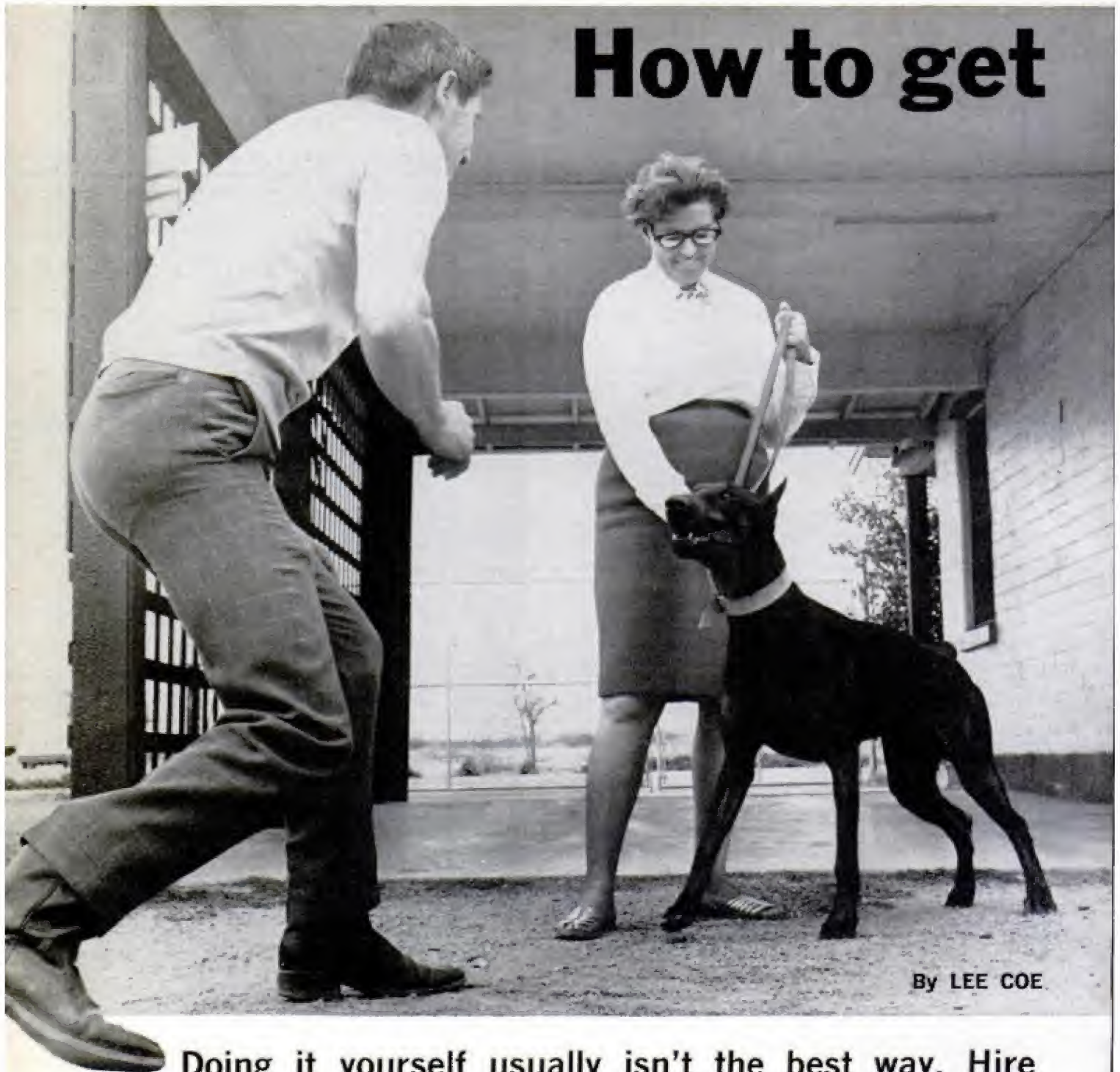


AFTER PULLED TOOTH (left) is duplicated in plastic (center), two holes are drilled in "root" end



FOLLOWING INSERTION, false tooth is wired to natural neighbor, and the wire covered with acrylic

How to get



By LEE COE

Doing it yourself usually isn't the best way. Hire an expert to give both you and the dog obedience lessons

AS THE CRIME RATE soars, many worried citizens are buying dogs for protection. But too often, new dog owners end up with pets that are really pests.

To be sure, a dog can be an ideal protector and companion. But where many owners go wrong is in the selection and training of their dogs. As a result, they live with animals that are ill-mannered and uncontrolled, that tug on the leash when walked,

jump on neighbors and occasionally even nip a visitor.

Would the owner be better off with a professionally trained guard dog? Not really. Such dogs—used by the military, police and security agencies—are taught to attack, and to respond only to commands given by their trainer.

Consider Duke, a German shepherd assigned to guard duty in an Ohio gas station. The dog took his job so seri-

a well-trained dog



A WELL-TRAINED DOG WILL remain seated at his owner's foot (left), regardless of the distraction, until released. Instructors combine control with leash and hand signal (center) to teach dog to lie down. Even without leash, disciplined dog will walk beside owner's left knee (right) when told to heel

ously that even after being shot three times recently by would-be thieves, he pressed his attack until they fled. When police arrived, he refused to allow them to enter the station until his owner came and ordered him away.

Professional dog trainers are well aware of the dangers inherent in giving a guard dog to the average family. Instead, they suggest a well-trained compromise that will be the companion and pet that 90 percent of the new dog owners today have in mind, but seldom get.

One reason for their disappointment is poor selection. Most dogs will instinctively protect what they feel they "own"—your family, house and surrounding area. Size doesn't make much difference. Even the toy breeds will make enough racket to scare most strangers away.

But when choosing a dog, remember

that many American canines are overbred. Steadiness and reliability, the most desirable qualities in a pet, are often sacrificed for physical standards needed to win blue ribbons at dog shows.

It's best to deal with the owner of a reputable breeding kennel. He can be worth many times his fee in helping to select the best individual dog for your family, rather than just a fashionable breed.

Remember, protection comes automatically to a dog, whatever the breed. The key is obedience, and that's what the owner has to add, since almost any dog can be taught to obey.

If you start with a pup, he should be taught to *come*, *sit*, *stay*, and understand the word *no*.

Trainers urge that dogs always be called by name when given commands. When they respond, professionals praise



HAND SIGNALS are a vital part of a dog's training, reinforcing an instructor's verbal commands

the dog, and occasionally reward him with a tidbit.

Teaching a pup to sit is simply a matter of holding him by the collar, saying his name, then adding the word *sit* while pushing his hindquarters down.

To emphasize disapproval, the word *no* may be accompanied with a cuff. A rolled-up newspaper is better than the owner's hand. The point is to frighten the animal, and he may not fear the hand that also rewards him with petting. Never wait to discipline a dog. When he does something wrong, correct him immediately because the dog must associate discipline with wrongdoing.

When a pup is six to seven months old, he's ready for formal training by a professional able to instruct owner and dog to work as a team. Obedience training on an individual basis costs about \$25 a week and takes an average of 10 weeks. A cheaper way is to join a group class.

Many organizations such as the YMCA or a chapter of the American Kennel Club sponsor obedience courses. They usually call for one class



GENTLE TUGS on a leash and a soft push on the hindquarters help a dog understand the order *sit*

a week for 10 weeks, but these instructions cost only one-tenth as much as individual lessons.

John Webb, an Arizona trainer with almost 30 years of teaching experience, estimates that about half the owners who attend a group course will graduate with an obedient pet. Another 25 percent will see a marked improvement in their pet's response to commands. The remainder will note little, if any, progress.

Courses are designed to teach the owner how to train his dog to come when called, walk at heel, sit or lie down on command, and remain in position when told to stay.

Professionals stress that commands must be given in a clear, forceful tone. Orders spoken in a timid way sound like suggestions, and a dog will usually ignore them. At the same time, teachers emphasize that firmness should not be confused with roughness, and they advise owners to use no more force than necessary to get the dog to respond.

The first command demonstrated in most group training classes is *heel*. Placing the dog in position at his left

leg, the instructor pulls the untrained animal's head up to get his attention while speaking his name and giving the order *heel*. As he gives the command, the trainer steps forward, moving his left leg first to give the dog the idea of motion. Then he jerks the leash.

Owners following the instructor's example soon find that a quick jerk is more effective than a steady pull, which the dog resists. After a few tugs, a dog learns that the tugging will stop if he continues to move forward beside his owner.

At the second session, instructors lead the class through the command *sit*. The owner walks his dog at heel. Upon stopping, he gives the command *sit*. The owner walks his dog at heel. A halt-sit habit means the dog must rise before charging off, giving the owner more time to correct him.

Down is an extension of *sit* and is taught next. The pet is placed in a sitting position with the leash coming from under his chin and looped under one of the trainer's feet. The trainer, saying *down*, pushes his foot to the ground, forcing the dog's head to follow. Simultaneously, the trainer puts firm pressure on the animal's shoulders, pressing him down.

Professionals warn that dogs often confuse *sit* and *down* at first, and urge



TODAY'S CUTE PUPPY will be tomorrow's 100-pound nuisance to adults unless he's taught the command no
FEBRUARY 1972



A DOG CAN BE MORE than a pal. Sharpen his protective instincts, and he'll be a loyal guardian

pupils to be patient, and to continue to demonstrate the two commands until the dog has learned what the difference is.

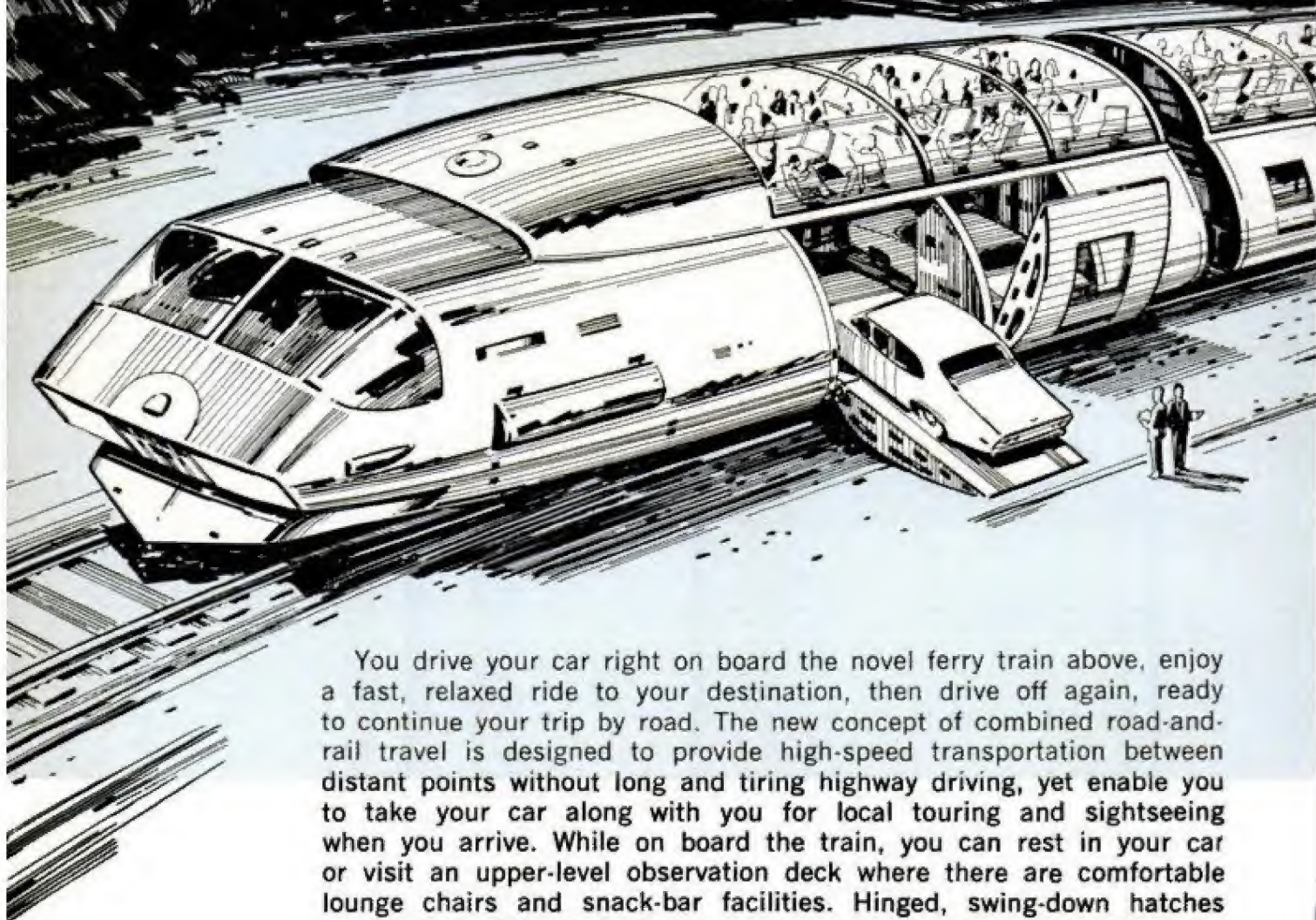
One of the most important orders taught in any class is *stay*. It is also one of the most difficult, and usually requires two persons working together—one holding the leash and the other enticing the dog. After having the dog sit, the owner places his right palm in front of the dog's nose and says *stay*. He then moves away until the dog tries to join him. At this moment, the trainer who holds the leash tugs back so that the animal resumes his sitting position.

If the dog cannot be repositioned, the instructor goes through the drill again until the dog understands the command. Eventually, a hand signal will be sufficient, and the owner can practice the command without another person.

Probably the most necessary command, the easiest to teach, and the hardest to enforce off-leash is *come*. In group classes, owners place their dogs in the sit position, then walk to the end

(Please turn to page 182)

Now it's ferry trains for



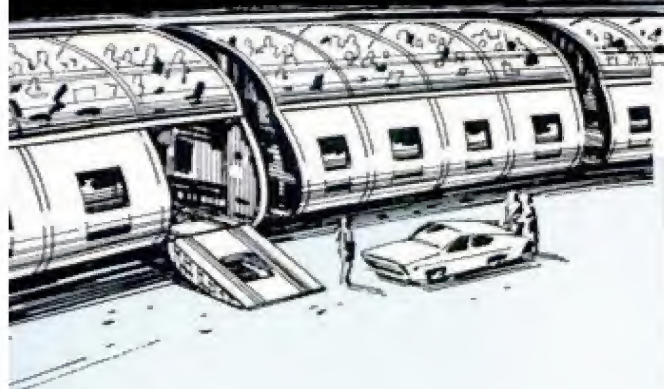
You drive your car right on board the novel ferry train above, enjoy a fast, relaxed ride to your destination, then drive off again, ready to continue your trip by road. The new concept of combined road-and-rail travel is designed to provide high-speed transportation between distant points without long and tiring highway driving, yet enable you to take your car along with you for local touring and sightseeing when you arrive. While on board the train, you can rest in your car or visit an upper-level observation deck where there are comfortable lounge chairs and snack-bar facilities. Hinged, swing-down hatches in the sides of the train form ramps so you can drive on and off easily. The idea was conceived by Veljko Milenkovic of Boulder, Colo.



Quick-release belt

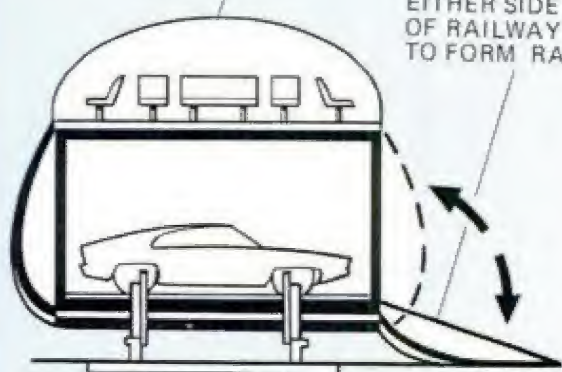
Motorists who hate to wear shoulder-type safety belts because they're so awkward to get in and out of will go for this ingenious idea. The upper end of this belt slides in a U-shaped track overhead. To put on the strap, you just swing it around the track across your shoulder until it locks into a small S-shaped bend. Reversing the process releases the belt quickly and easily without undoing the clasp. There's no need to adjust belt tension each time since the length can be preset and left alone. Inventor is John R. Hane, Box 444, Shalimar, Fla.

cars yet!



UPPER
OBSERVATION
DECK AND
LOUNGE

HATCH SWINGS
DOWN FROM
EITHER SIDE
OF RAILWAY CAR
TO FORM RAMP

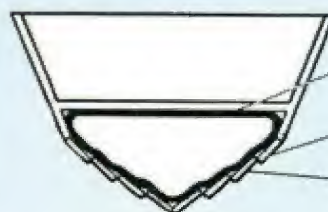


Illustrations by Roy Grinnell



COMPARTMENT
DEFLATED

HULL FLAT FOR
HIGH-SPEED PLANING
ON CALM WATER



INFLATABLE AIRTIGHT
COMPARTMENT

HINGED SLATS WITH
FLEXIBLE LINING

HULL V-SHAPED FOR SMOOTH
RIDING IN ROUGH WATER

Self-adjusting boat hull

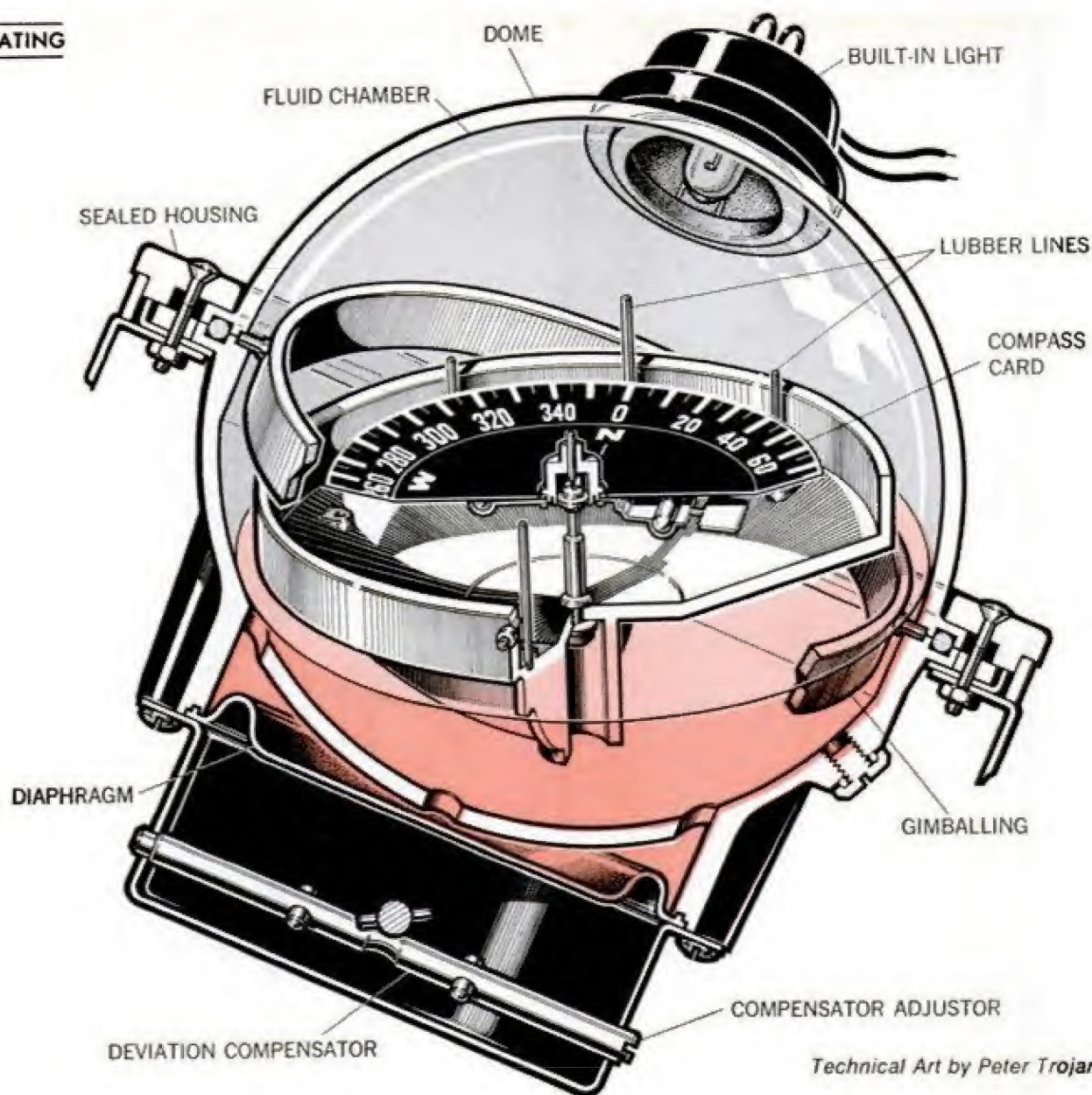
You want a flat planing hull for high speed on calm water, but a deep V-bottom for smooth going in rough seas. With this adjustable hull, you could have both. It consists of flexibly hinged strips with an inflatable air bag inside. As the water roughens, a motion-sensitive device automatically inflates the bag to force the strips into a V shape. Harold L. Walker, Whitestone, N. Y., is the inventor.

Electronic 'money'

No money changes hands when you fill up at this electronic gas pump. You simply insert a coded card in a slot and the pump "draws off" or erases a number of magnetic pulses equal to the number of gallons you purchased. When all the pulses are used up, you take the card back to your bank and have it "recharged." The pump totals up the pulses "taken in" each day and records them on a card the garage owner can convert into cash at his bank. The system, now in use at some British gas stations, is being considered for restaurants, supermarkets and other stores. It was devised by Bernard Hunn, Revenue Systems, Luton, England.

FEBRUARY 1972





How to Choose a Marine

By MORT SCHULTZ



CUPPED CARD COMPASS, sometimes referred to as the direct-reading type, has the lubber line facing the pilot. This type ranges in price from \$10 to \$50



FLAT (OR DISHED) COMPASS CARD has lubber line opposite helmsman, ranges in price from \$20 to \$300. One above is designed for binnacle mounting

POPULAR MECHANICS

ALTHOUGH MOST OF US never take our boats out of sight of land, our whereabouts situation can deteriorate mighty fast if fog or bad weather suddenly sets in. Many boatowners have had to grope for a shoreline they could no longer see.

Safety, then, is obviously served by installing a magnetic compass in your craft—large or small, power or sail.

According to the Coast Guard at Sandy Hook, N. J., boats operated in semisheltered waters (bays, for example) and in the ocean should always be equipped with compasses.

The Coast Guard also believes that a compass is a necessary instrument in large bodies of sheltered water. As one Coastguardsman put it, "Boatowners have been known to go around in circles for hours after being caught by fog in the middle of large lakes."

Since compasses range from \$10 to \$300, there is apparently more to buying one than simply deciding to do so. You could spend money needlessly by equipping your boat with a compass that has unnecessary features, such as a finely graduated card (1° increments), brass construction, full gimbal (the part that keeps the compass steady when everything else is heeling), built-in deviation compensators and nighttime illumination.

Yet, an expensive compass doesn't usu-

Compass



FEBRUARY 1972



IF DEVIATION BECOMES A FACTOR due to nearby metallic equipment, external deviation compensators (top picture) will offset error. A compass that's readily removed (middle and just above) provides easy storage and consequent theft protection. Bracket design permits attachment to vertical or slanted surfaces—ideal for small, uncabined boats



FOR QUICK CHECK of accuracy, move a screwdriver close to compass. It should pull card around 10°. Take tool away and card reverts to original setting

WHATEVER WAY you mount your compass, it will serve you best if situated close to the helm (left)

ally possess any stronger internal parts than an inexpensive compass. That's what one leading manufacturer says.

"The basic components used by reputable compass manufacturers that bear on the instrument's reliability are generally the same from model to model," B. L. Sherman of E. S. Ritchie & Sons claims. This company has been making marine compasses since 1850.

"For example," Sherman points out, "our \$20 compass uses the same hardened-steel pivot and pivot bearing as our \$300 compass."

You can get a pretty good idea of what price compass you need by the type of boat you own. If it is powered and under 15 feet, a compass in the \$10-to-\$20 range will probably be adequate. These have cupped cards that are graduated in 5° increments.

Compasses with cupped (or conical)

Price of the compass depends pretty much on the size of the card and its incrementation

cards resemble those used in airplanes. Often called direct-reading compasses, they have the lubber line aft, nearest the helmsman. The card rotates under this fixed reference line, which allows you to take eye-level readings.

Compasses that have flat cards are intended for larger powerboats. Regarded as the more traditional instrument, their lubber lines are forward so that the helmsman has to look across the card to get a reading.

Flat-card compasses provide greater magnification than cupped-card instruments and give a more detailed reading. The price of the compass depends pretty much on the size of the card and its incrementation.

Cards are 3 to 6 inches (or more) in diameter. The larger and most expensive compasses are graduated in 1° increments. They are intended for boats that are designed for far-ranging, open-water cruising. The dished card is simply a variation of the flat card.

Be aware that you will probably find some fairly expensive (\$40-\$50) compasses that have cupped cards. They have more features than the less expensive

cupped-card instruments, such as bronze construction, internal compensators, or what have you. We'll speak of the need for these features in a minute.

But first, let's discuss compasses that are designed for sailboats. They can have cupped or flat cards, but should possess two features that owners of power craft don't need and would waste money getting: full gimbaling and multiple lubber lines.

Unlike a powerboat owner, a sailboat owner has heel to consider when selecting a compass. A compass with limited or semigimbaling can compensate quite nicely for the limited angling that a power craft may experience. Not so with heeling.

Full gimbaling can either be external or internal, with the latter providing a maximum degree of hold-steadiness. It is therefore intended for more than the straight pleasure type of sailboat. Racers, for instance, would be best served by a compass having full internal gimbaling.

With internal gimbaling, the card itself is mounted on a full gimbal arrangement to assure levelness at any angle of heel. These compasses sell for \$50 and more.

With external gimbaling, an external ring provides for four pivot points. This compass costs about \$15 to \$20.

Multiple lubber lines make it possible to sight relative headings from any position in the boat. This is important for sailboats since the crew as well as the helmsman should be able to take compass readings in order to detect wind shifts.

What else should you look for in a compass? This depends pretty much on your boat and what use you make of it. However, the following list of check points will guide you to the one compass you need:

- *Built-in deviation compensators* are nice to have if the compass is to be mounted where the engine or equipment will cause deviation. However, if you have an outboard, you can save \$5 to \$10 by not getting this feature. Since the engine is located in the stern, it won't cause much, if any, deviation. Sailboats don't need internal compensators either.

However, should deviation occur, the problem could be caused by steel cores in a plastic steering wheel, electric windshield wipers (only when operating), steel framing in a folding canvas top, a steel shaft in the steering controls, or untwisted electric wiring that's within a foot of the

(Please turn to page 176)



Painted stripes make hazardous road safer

Researchers at Britain's Road Research Laboratory painted stripes across a notoriously dangerous section of highway and found the accident rate "dropped dramatically." Key to the system is the spacing. In the first series, stripes are 30 feet apart to alert the driver. Next is a series 15 feet apart, which make the driver feel he's still going too fast. Finally, they're 7½ feet apart, causing the driver to slow enough for the hazard.



High flier

Recently released by the Navy is this artist's rendering of a proposed patrol aircraft, the "very high-altitude, ocean-surveillance-system aircraft." Most details are classified. Wingspan is about 200 feet; fuselage length, about 80 feet. With a two-man crew, the plane would fly at high subsonic speed at 100,000 feet, scanning the ocean on flights of up to eight hours.

ACV on ice

Tests to determine how air-cushion vehicles perform in the Arctic are being carried out by the Navy and Coast Guard. This vehicle was disassembled in San Francisco, flown north to Point Barrow, then re-assembled. Tests cover operations over ice, snow, water, tundra.



NEWS BRIEFS



Japan's first supersonic jet

The first supersonic aircraft designed and built in Japan is Mitsubishi's tandem two-seater, the XT-2. Intended for use as a trainer and fighter, the Mach 1.6 craft is powered by two Rolls-Royce turbofan engines. Design features include the use of spoilers rather than ailerons.

Each wheel has a motor

Running on a one-third-mile test track near Madrid, the Vertebrado, an unusual elevated train, has hit speeds of 125 mph. Each rubber-tired wheel of the train carries its own motor. The train can be made up of 6, 12 or 24 sections to hold 3.7 passengers per linear yard of train.



Can't hide from Friskem

That long knife tucked inside Denise Vickery's hot pants would not get by an Eastern Airlines passenger gate equipped with Friskem. Its glowing black box held at right shows there's a metal object being carried on her person.



FIREFIGHTERS' SKY HOOK



The L. A. fire department uses helicopters as command posts, pumpers, ladders, ambulances, hose pullers—and even instant hydrants

By RALPH EMERSON

THE HELICOPTER IS A VERSATILE BIRD—ambulance, rescue vehicle, gunship, passenger carrier, airborne crane. Now it's proving itself as a "fire engine."

Some years ago the Los Angeles City Fire Dept. acquired its first copter for use as an aerial command post. Today, the department's helicopter unit comprises five multipurpose machines, seven flying firefighters, three relief pilots and a rescue crew.

Directing operations from the air is now only one of many duties that the choppers perform. They've





"WATERBOY" HELICOPTER refills 1000-gallon portable bag dropped to firemen far from a hydrant



proved valuable as flying "pumpers." Equipped with an aluminum or fiberglass belly tank, the copters can "bomb" a hot spot by releasing more than 100 gallons of water in one shot, or they can spray a larger area to retard the fire until ground units take over.

Once firemen are on the scene, especially in outlying areas, the helicopters become flying workhorses hauling hose. The choppers can pull and lay 1200 feet of 2½-inch hose in three minutes over rough terrain from a truck or large reel. Firemen hauling and tugging that much hose over similar ground would take up to an hour to do the job—and probably arrive too exhausted to wage an all-out fight on the fire.

But what if the fire is in one of Los Angeles City's remote canyons where brush fires are frequent and water hydrants scarce? Using their helicopters, firefighters can drop an empty, collapsible rubber tank, plus a portable pump and some hose. A "waterboy" copter flies in next to fill the 1000-gallon tank. Using the airlifted hydrant, firemen can pump 80 gallons per minute on the blaze as helicopters form a high-flying bucket brigade to keep the tank replenished.

The L.A. department's helicopter squadron began with a Bell 47B-3B bird able to cruise at 70 to 80 mph for approximately 2½ hours. Initial success led to another Bell 47B-3 with a slightly longer range. In addition to a pilot, both ships can carry two pas-



SPECIALLY TRAINED FIREFIGHTER leaps from helicopter 15 feet above the ground if ship can't land



HELICOPTER AMBULANCE can carry two injured persons on stretchers plus an equipped first-aid man

IN REMOTE AREAS, the helicopter may be the only piece of equipment that can reach a brush fire and bombard it with water



sengers, or two stretcher baskets that are strapped outside the cabin.

Three Bell Jet Rangers able to stay aloft for three hours while flying 140 mph make up the rest of the fleet. The Rangers can carry three firemen in the rear seat and a fourth in front.

To earn their wings as firefighting pilots, candidates must have a minimum of 500 hours' flying time, a commercial rating and at least five years' experience in the fire department.

Firefighting know-how as well as flying ability is necessary because pilots often act as the airborne eyes of the department, helping to coordinate equipment on the ground. At other times when flying "high hazard patrols" over California's tinderbox hills, pilots must act as aerial fire lookouts.

When not fire-spotting or firefighting, the helicopter brigade flies a number of mercy missions, easing into secluded or remote areas out of reach of ground rescue crews.

To meet those challenges, the department has organized specially trained "helitack" crews. These firefighters, highly skilled in first aid, personnel rescue and spot-fire control, are able to jump off a copter flying 15 feet above the ground.

The ships have also been specially equipped to handle such rescues, carrying a powerful spotlight attached to the belly, and an electrically operated hook that can be lowered to lift an injured person out of a tight spot, or

FEBRUARY 1972



WHEN FIRE KNOCKS OUT elevators, firemen call on helicopters to hoist lifesaving gear to the roof



LAYING 1200 FEET of hose in under three minutes by helicopter eases firefighting in rough terrain

hoist lifesaving equipment to the top of high-rise buildings where fires have knocked out the elevators.

Los Angeles firemen are reluctant to put a limit on the tasks their air brigade can do. They point to last year's earthquake in southern California as an example of its versatility.

When the local Veterans Administration hospital collapsed, all telephone lines went dead, and the Civil Defense radio was knocked out. But flying firefighters spotted the damage, and radioed in a ground rescue team.

★★★

The new outboard motors: more power—less pollution

Harness up to 140 horses on the back of your boat this year with an engine that keeps fuel spills to itself



THAT COMPACT POWER PACKAGE you hang on the stern of your boat has gone up in power again and, once more, pole position in the horsepower derby goes to Mercury Motors for 1972. Mercury supplies a record 140 hp of two-cycle torque with its strongest production kicker ever—and that's just the official rating. Set up a racing rig and you can special order a throaty 150-hp Chrysler with dual open-stack tuned exhausts, or high-performance limited production mills made by Evinrude, Johnson and Merc as well.

How many horses are hidden under the cowls of these exotic race-course rigs? You only get a grin when you ask plant engineers, but Molinari-type tunnel hulls



JOHNSON 125 leader has low cowl. Mercury's "tower of power" is 140 hp



NORSEMAN is new name for Evinrude's versatile 40-horse unit designed for fishing, skiing or specialty-boat power

have topped 100 mph with them and good guesses rate the compact herd of stallions inside at around 175—plus a few more squeezed in by the factory tuners after almost every race. That's more push than your rowboat should ever try to pack along, but these competition rigs do good development work for the dependable big-muscle mills that are turning houseboats and cruisers into outboard craft.

This year nearly all outboard companies have also modified their motors so no unburned fuel is dumped. Despite scare stories by a newspaper columnist, there has never been proof that the small amount of gas-oil spill from pleasurecraft outboards caused ecological damage or stopped the fish from biting. But the major makers are now engineering their two-cyclers to recycle any fuel not initially burned through the engine. As of now, however, they warn against the use of unleaded gas in two-cycle mills. Chemicals replacing the lead might critically damage metals inside your motor.

As for straight production outboards your dealer is sure to stock, Mercury offers the six-cylinder Model 1400 with 140 hp, swinging down through 10 models to a 4-hp kicker that even has surface-gap sparkplugs and capacitor-discharge ignition developed

FEBRUARY 1972



CHRYSLER'S 150-hp, high-performance race model is a honker with dual tuned exhausts

for the big jobs. In the middle is an all-new three-cylinder direct-charged 650 with 65 hp from its 49.8-cu.-in. engine.

Chrysler's big one for the family rig has 130 hp. Others range



AUTOELECTRIC is Chrysler's name for motors like this 9.9-hp with key start and cowling dome light



MERC 650 is a new 49.8-cu.-in. three-cylinder Mercury mill designed for a compact package of 65 hp



LARGEST standard Chrysler is 130-hp motor mounted on 16-foot Conqueror from Chrysler boat division



NEW SEAHORSE by Johnson is 65-hp three-cylinder model claiming better fuel economy than former 60

down to the Chrysler 3.6 Swinger in seven power selections (eight, counting the racing 150). The 9 and 12.9-hp models provide the Autoelectric features: key starting, domelight and 10-amp generator. All engines come in standard or long shaft models.

Evinrude has 13-plus models, a big plus since its special-order, high-performance Strangler has been taking on Merc's Twister and Johnson's Stinger at the all-out enduros. Regular production motors run from a tiny two-horse Mate to the 125-hp Starflite. Tuned exhaust of the new 49.7-cu.-in. Triumph 65 adds 5 hp to last year's 60 with no increase in size or weight.

Johnson's 50th anniversary line has 12 hp classifications. A new Seahorse 65 is claimed to use less gas and deliver more power than last year's 60. The Seahorse 20 has a two-horse edge on Evinrude's Fastwin 18. Other 2-to-125 powers are similar to Evinrude's.

Sears, Roebuck, among six models, offers a stronger 3½-hp and others to 7.5. Small-hp brands start with the 1-hp Mini Motor and 1.7 Mighty Mite, and Eska, Golden Jet, Clinton, Triton, Aeroceanic and Commando. The 55 and 85-hp Bearcats are four-cycle, and an outboard claimed to burn diesel fuel or gas is under development by Dynatech. Imports will include British Seagull, German Zundapp and Swedish Archimedes Penta. ★ ★ ★

OUTDOOR HINTS



Canvas top for shady trolling comfort

When they're biting, a fisherman wants cockpit room to maneuver. This canvas top mounted on a light aluminum tubing framework allows a small-boat luxury: standing headroom. Side curtains can give added rain and sun protection.—*Lee Schrimpf, Tulsa, Okla.*



Prescription for organizing pack stowage

Plastic prescription vials can keep dry your fishing swivels, snaps, sinkers, hooks, monofilament, thread, fiberglass repair tape, battery, silicone cloth—and medicine. Containers fit neatly into pocket or backpack.—*H.O. Davidson, Washington, D.C.*

Campfire hang-ups

Backpackers can use a short length of easy-to-stow brass jack chain or 50-lb.-test stainless leader wire to hold a pot over a fire. Form 8 and 12-in. lengths in loops joined with center ring, "S" hooks.



Easy mini-awning

No space in a crowded campground for a full-sized awning? To get some shade, drape aluminum-colored rubberized nylon cloth or other fabric over the top panes of a sunny window, letting the edge hang down about 4 in. Hold it in place with clothespins.—*Francis T. Hiner, Sidney, Neb.*



Musical fence

A resident of North London, who felt that his house was too dull, decided to brighten up the place with a "musical fence." With the aid of a local ironworker, he erected a fence on which the opening bar of *Home Sweet Home* appears.



Laser-beam lighthouse

The world's first laser-beam lighthouse, which is just 7½ feet high (bottom photo), stands 146 feet above sea level on a platform supported by the columns of a memorial at Point Danger, Australia. The compact light uses only 200 watts of electricity.

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Green means parking space

The city of Aachen, Germany, has added a lighted-arrow system to municipal parking-lot direction signs so that motorists will know in advance which lots are full and which have space. A red arrow means that parking lot is full; a green one means there's space.

POPULAR MECHANICS



Floating skimmer slurps oil

They call it SLURP (for self-leveling unit for removing pollution), a name that graphically describes its function: gobbling up oil spills. Developed by British research scientists, the 60-pound device floats on the surface and sucks in the surface liquid, which is pumped to a container ashore. As pumping rate is increased or decreased, the skimmer floats higher or lower in the water, enabling the operator to skim off a thick or thin oil slick more efficiently.



Dangerous silos

Radioactive waste from an experimental station in Denmark is stored in 126 concrete silos that must remain closed indefinitely—or until a system is developed to make the waste harmless. Radioactivity disappears only as the isotopes exhaust their working lives.

FEBRUARY 1972



Russian snowmobile

A new Soviet snow machine, the Amuret, made the Promsvyaz Works in Khabarovsk, performed well in a long-distance test run, according to the maker. The 20-mph vehicle, designed to operate in temperatures as low as minus 50°C., can be fitted with wheels.

Dollar duck decoy



More duck for the buck is your bonus when you build your own. This life-size bufflehead should bring in flocks of real ones to your blind

By NICK KARAS

THERE ARE FEW THRILLS greater than the sight of a flock of ducks coming into a rig of decoys, especially when you made the spread yourself. Decoys, and plenty of them, are as important to a waterfowler as shotguns

and shells. Today's prices make a full rig of decoys expensive, however. The easy solution is to make the decoys yourself, and while you're at it you can make them hollow to decrease the weight.

DRAW THE PATTERNS of decoy head and body on $1\frac{1}{4}$ or $1\frac{1}{8}$ -inch board of the wood stock selected

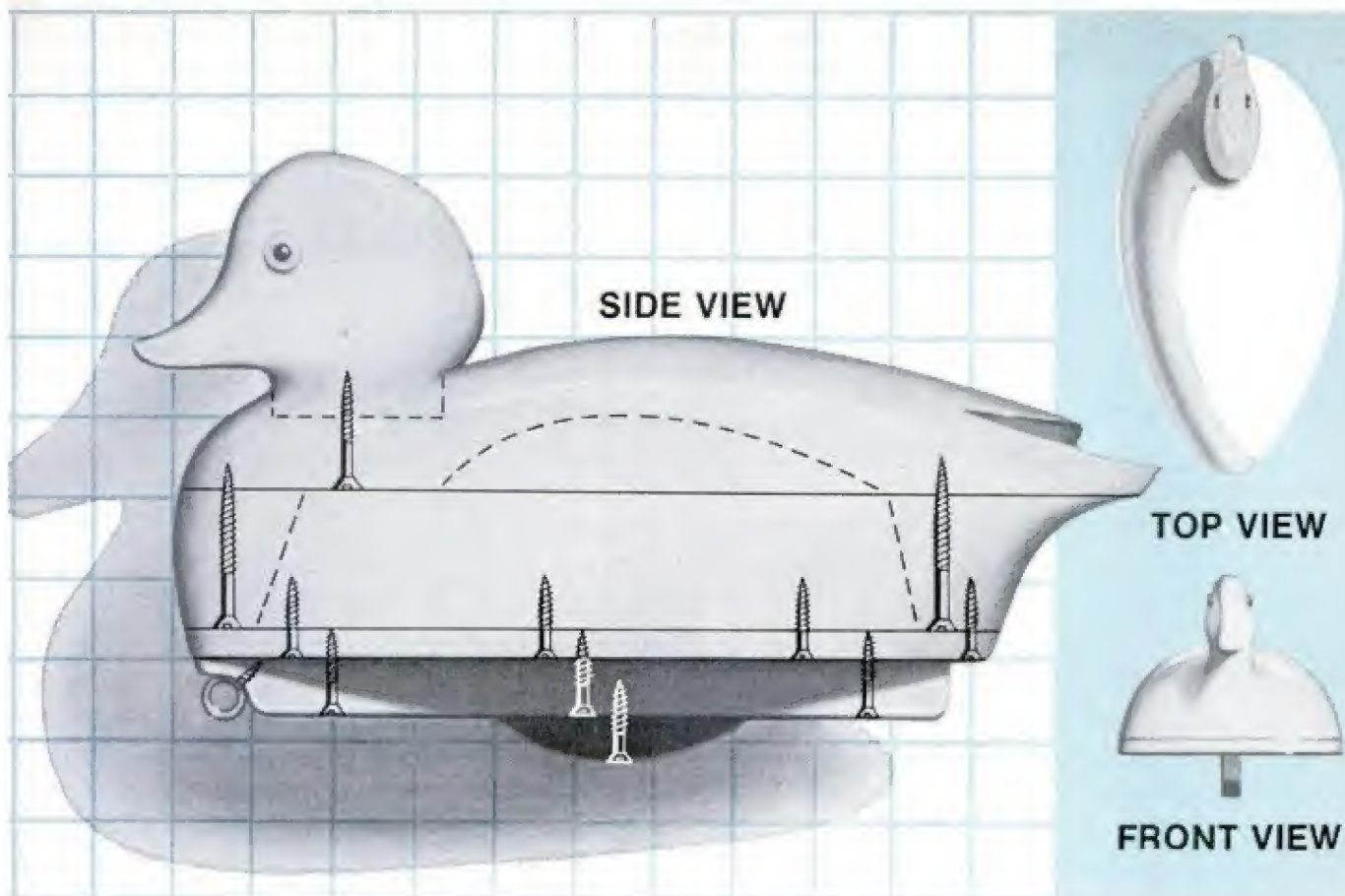


FOLLOWING THE LINES traced from around the patterns, cut sections with a sabre or jigsaw



JOIN TOGETHER both duck body pieces using long screws. Brass screws give decoy a longer life





Shown here is a bufflehead decoy, a small diving duck found along many of our coastal marshes as well as large inland lakes and rivers. The cost of this model was 96 cents (wood, 55 cents, screws, 18 cents, paint, 8 cents, eyelet, 2 cents, eyes, 6 cents a pair, plus about 7 cents' worth of lead). Costs may vary slightly depending on your choice of wood and whether you use brass or iron screws.

A good pattern is the first essential in making a decoy of any goose or

duck species. You can design your own patterns or develop them from photographs of ducks or some books on duck hunting that show top profiles of various ducks.

The pattern chosen should produce a decoy with a high body silhouette when the decoy is on the water and easily seen by flying ducks. The head should be in a natural at-rest position and not so high or extended that it might resemble the bird's alarm position. The pattern should also yield a

IF YOU USE NAILS to hold body sections together for shaping, they can then be rescrewed, glued

DRAW-BLADE KNIFE or spoke-shave gives the decoy an initial shape before smoothing, sanding

DRUM SANDER WAS MADE from an old washing-machine motor. A coarse sandpaper covers the drum





WINGS ARE SKETCHED on body of decoy. Books on duck hunting will have photos of wing shapes



FOLLOWING THE TRACINGS, now groove the outlines of each wing using a fine gouge to show shape



ON BOTTOM PIECE, cut out the center portion about one inch in from the edge using a sabre saw

body wide enough to give the decoy lateral stability in rough water, keeping unnatural roll and pitch at a minimum.

There are several types of wood suitable for making your decoys. Each offers some advantages and problems. Cedar is rather light in weight and will hold up to prolonged periods in water. Heavy-density balsa is very lightweight and easy to work, but quite expensive and easy to mar. While northern spruce is cheap, it has a tendency to be knotty and splits after being in the water too long. Sugar pine is easy to work, won't split in water, waterproofs easily but can be expensive and difficult to obtain.

But white pine is probably the best compromise. It is easy to work, moderate in cost, fairly light in weight, especially with a hollow decoy, and when

properly treated, the wood will be water-resistant for its lifetime.

Before following these step-by-step photos, carefully select pieces of lumber that are as free of knots as possible. If knots can't be avoided, place the knots in the middle of the patterns toward the bottom where they will later be cut out. The top body piece must be knot-free.

As shown, the tools for the job are simple and inexpensive. A draw blade or spokeshave is your most valuable tool, followed by a half-round bastard file, a wood rasp and a small rattail file. For power equipment, a good jig-saw or fine bandsaw is ideal, but a sabre saw is handier. It should be capable of cutting through two-inch stock. The most valuable tool on the power side is a sanding sleeve or drum mounted on a motor. Mine is an old

REASSEMBLE the two body halves after cutting center out of lower half to give decoy lighter weight



DECOY HEAD CAN BE shaped to near completion with the sanding sleeve. Outline bill with gouge

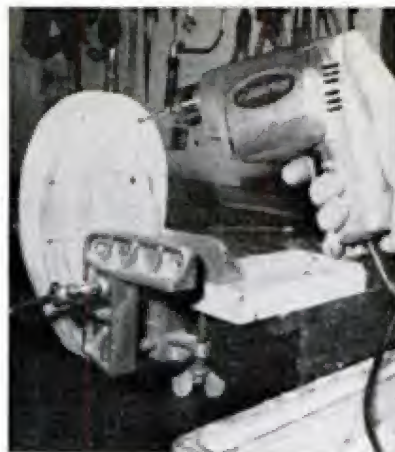


CUT RECESS IN BODY and fit head into the slot, securing it in place with waterproof glue, screw





SCREWS ARE USED in the final assembly to hold head to body and all sections glued together



PREDRILL HOLES for screws so they secure easily with little chance of splitting the light wood



BOTTOM PLATE IS GLUED and screwed on, followed by keel. A lead-weighted keel steadies decoy

washing-machine motor and a drum with coarse sandpaper.

After head, top and bottom body parts have been shaped out and assembled, painting should be done with a completely no-gloss finish that can be obtained from hunting supply houses. Matching the exact colors of the live birds is less important than using paints that reflect no light. Sunlight bouncing from floating decoys can spook an incoming flight of birds, so household glossy or semigloss paints are unsuitable. Decoy eyes can be obtained from supply houses that offer taxidermist equipment. Good glass eyes are much superior to painted nailheads. Add more lead aft if the decoy tilts forward.

For quick production of my decoy flock, here are the steps I follow. On a plank of 1 $\frac{3}{4}$ or 1 $\frac{7}{8}$ -in. cedar I trace the body and head patterns I have

worked out. Using a sabre saw I follow the scribed lines to cut out the two-piece body and single head. Wood screws join the two body sections; then the top of the body is rounded to shape with a draw-blade knife.

As refinements, wing outlines are drawn on the body and grooved with a fine gouge. I cut out an oval from the center section of the lower body piece to lighten the decoy and then, with shaping finished, rescrew and glue the body sections together.

For this and other shaping jobs, I use the motor from a discarded washer with a drum fitted on the shaft and covered with coarse sandpaper. Head shaping is easy with this drum.

Weighted keels to give level floating, glass eyes, and several dunkings in hot linseed oil are followed by a finish coat of nonreflective paint. ★★★

GLASS EYE from taxidermist supply house is more authentic than nailhead painted to match



TO WATERPROOF DECOYS, dunk each bird in hot linseed oil for five minutes. Repeat three times



PAINT DECOYS WITH EXTERIOR flat colors and dry completely before floating them in water



Roll-around camera dolly lets you sit

By ROSS SCOTT

T HIS WHEELED DOLLY not only rolls you easily into position for any camera angle, but it even lets you sit down while you work. The sliding camera arm can be moved up and down on the main column to any desired height and can also swivel sideways in any direction. In addition, the short upper camera post can itself be rotated and tilted to any position. The combination of movements enables you to put the camera anywhere you want it and to switch quickly to other positions when shooting objects from a variety of angles and levels.

The column, arm and post are all made from standard pipe and fittings. The size you use depends on how sturdy a rig you want and the weight of your camera. One-inch pipe provides a rug-



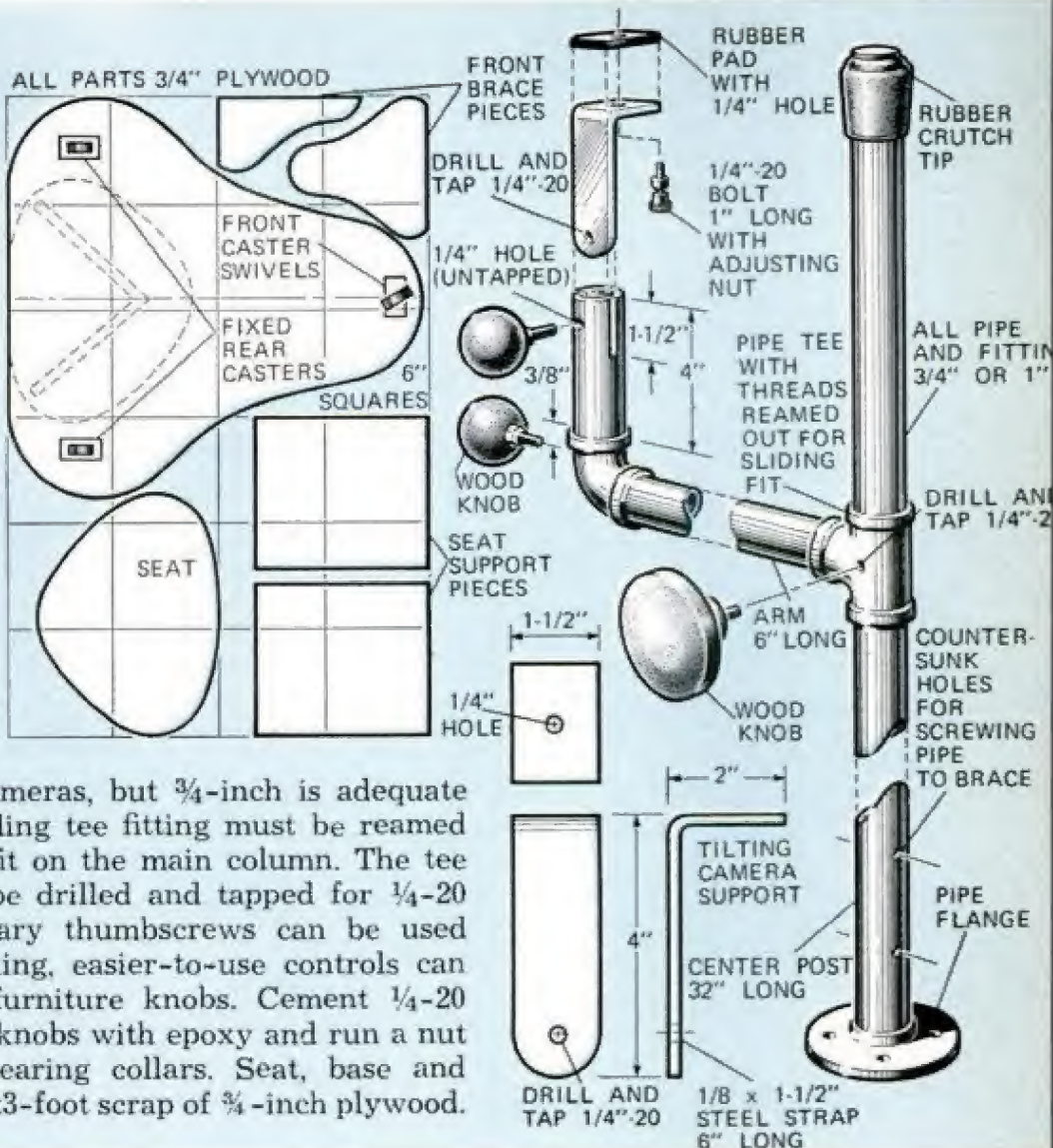
Key holder prevents loss

The thin filter key supplied with many Super-8 movie cameras is easily mislaid. You can prevent this by strapping the key to the camera with a loop of elastic tape. Feed the loop ends through the key openings, then around the camera body. —Walter E. Burton, Akron, Ohio

Handy darkroom tanks from food containers

The plastic containers you buy ice cream in make ideal auxiliary tanks for using and storing darkroom solutions. The snugly fitting squeeze-on lids seal the containers tightly enough to provide long life for such chemicals as fixer, hypo eliminator and antistatic rinses. Leaving the solutions right in the containers saves the bother of pouring them back and forth between jars and tanks. The containers will take most sizes of developing reels up to those used for 2¼x2¼ negatives.—Jackson Hand, Westport, Conn.





ged support for big cameras, but $\frac{3}{4}$ -inch is adequate for most uses. The sliding tee fitting must be reamed out for a smooth slip fit on the main column. The tee and elbow must also be drilled and tapped for $\frac{1}{4}$ -20 locking screws. Ordinary thumbscrews can be used here, but smarter-looking, easier-to-use controls can be made from wood furniture knobs. Cement $\frac{1}{4}$ -20 headless bolts into the knobs with epoxy and run a nut on each to provide bearing collars. Seat, base and braces are cut from a 2x3-foot scrap of $\frac{3}{4}$ -inch plywood.

Quick way to make multiple enlargements

The normal procedure of setting your darkroom timer by eye is fine for one or two prints, but when making 15 or 20 duplicates, it becomes slow and clumsy and you have to be careful to set the timer hand at exactly the same point each time for uniform results. You can speed up the job by drilling and tapping a series of small holes around the timer dial—



one at each second mark. A 10-32 tap is a good size for this. Screw in a small bolt at the desired number of seconds to act as a stop. Switch on the timer, turn the knob until the hand hits the stop, then let go. For multiple prints, simply leave the timer on and keep turning the knob and letting go—as fast as you can change paper in the easel.—Richard Kent, East Natick, Mass.



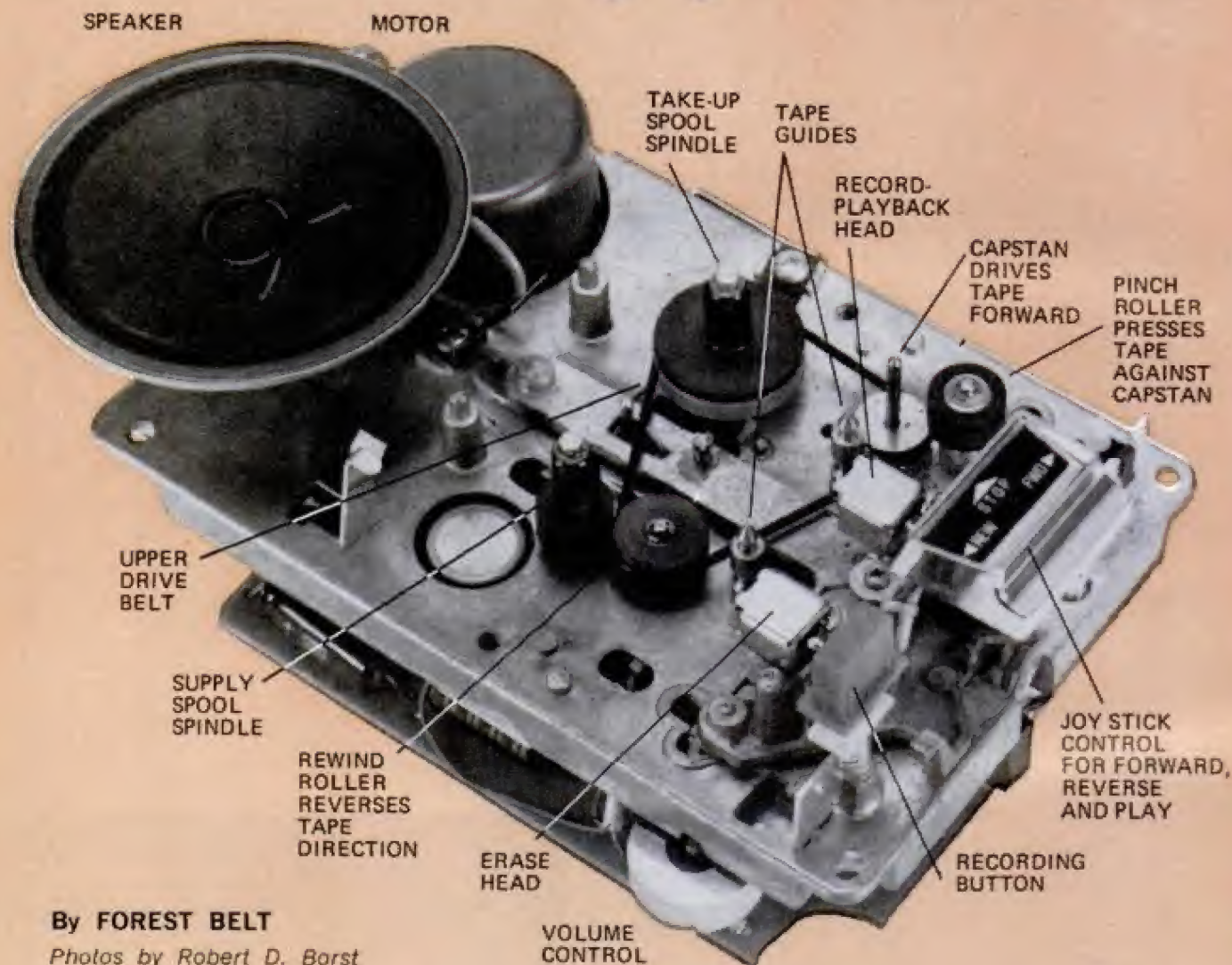
Improvised floodlight

Need an emergency photo-flood reflector? You can make one up quickly if your wife has a heat or sun lamp—the type with a wire guard around the bulb. Wrap guard with aluminum foil, pressing it firmly in place inside and outside.—Robert Hertzberg, Flushing, N. Y.

Cassette recorder repairs?

Most are simple.

Many you can do.



By **FOREST BELT**

Photos by Robert D. Borst

CASSETTE RECORDERS may seem complicated, but actually they're basically simple. They all work pretty much alike, and in most cases their parts are readily accessible. Before you throw up your hands at a balky machine, try these quick and easy fixits. Chances are, they'll get an ailing machine back in shape with out your having to resort to major repairs.

Weak or dead batteries in a portable recorder cause more problems than you may realize. This may sound a little silly

—like checking to see if the power cord is plugged in on a dead appliance—but it's such a simple thing it's often overlooked—just like the power cord that *did* unknowingly pull loose. Run-down batteries cause variations in tape speed that produce "wow" sounds or make the musicians seem to be playing in a tub of molasses.

If the drive spindles turn normally when the machine is empty, but stop or slow down the minute you insert a cassette, this generally indicates the batteries



JUST DROP IT IN and special cassette tape above automatically wipes heads clean as it runs through the machine. Such aids, while not a substitute for

more thorough hand cleaning, are convenient for occasional use. Also available are test tapes that check for wow, frequency response and other factors

are weak—just strong enough to drive the spindles freely, but unable to take the added load of the tape.

If your recorder has a 117-volt a.c. adapter, make a quick check by switching to this. If it performs well on house current, the batteries are obviously the culprit. In replacing them, change the whole set—batteries in series wear out about evenly. Also make sure the battery terminals are clean and make firm contact.

When the machine won't budge with a tape inserted, but purrs along smoothly when you take it out, the cassette itself may be at fault. The tiny tape inside sometimes snarls or spills so it runs sluggishly or jams the drive mechanism. The answer here is to try several other cassettes. If the machine checks out okay on these, you can blame the first cassette. But don't throw it away. A snarled tape can often be cleared by running it rapidly back and forth. Try to get it to move on "Fast Forward," then reverse it and run it backward on "Rewind." Do this several times, then see if it will run through at

normal forward speed. If your recorder doesn't have a Fast Forward, rewind the cassette in one direction, then flip it over and rewind it the other way. This has the same effect as running the tape forward at fast speed.

The next most common cassette trou-

TYPICAL CASSETTE-MAINTENANCE AIDS are shown below. They include cleaning and testing tapes, a cleaning and lubricating kit and a demagnetizer. In left background is special stroboscopic test tape





WEAK BATTERIES can cause more problems than you may think. Replace them frequently and in sets—not one at a time. Be sure cells are correctly inserted according to polarity markings inside case



REMOVING BOTTOM of case usually exposes underside of chassis, motor and flywheel (above). It may also release handle and other small parts. Note how they fit together to facilitate reassembly. Using a cotton swab dipped in alcohol, clean oil and grime off motor pulley and flywheel (below). Such dirt can cause belt slippage, varying drive speed



bles are the periodic buildup of magnetism on the heads and the dirt and grime that collect on the heads and in the drive mechanism. Dirt on the heads prevents the tape from making good contact, clogs the delicate head gaps and quickly reduces sound quality. Oily grime on the capstan, pulleys and drive belts causes tape slippage that, like weak batteries, results in wow, erratic tape speed and annoying fluctuations in musical pitch.

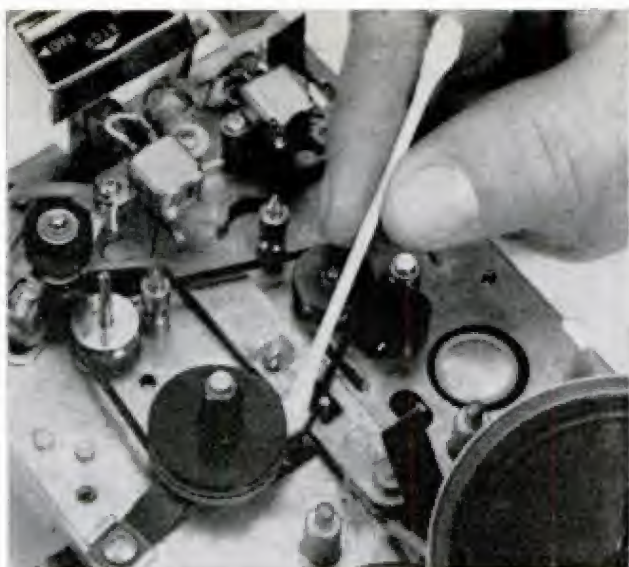
Cleaning and demagnetizing the heads can be done on most recorders without dismantling them. This should be done at least twice a year—more if you give your machine heavy use. The heads pick up magnetic charges as the tape moves past which interfere with proper recording and playback of magnetic signals on the tape, resulting in poor sound reproduction.

Small demagnetizing tools cost a few dollars at electronics and hi-fi shops. You plug the tool into 117-volt a.c. and move its tip back and forth a few times across each head. Keep the tool from actually touching the heads to avoid damaging the delicate surfaces. The tip should just brush lightly by them. Be sure no prerecorded tapes are lying nearby as they may be demagnetized and erased accidentally.

For cleaning the heads, you can use ordinary denatured alcohol or special solvent sold for the job. Apply it gently with a cotton swab, as shown in the accompanying photos. Particles of magnetic oxide rub off the tape during playing and must be thoroughly cleaned out of the

TO REACH TOP SIDE of mechanism, remove screws holding chassis frame to case, then carefully lift chassis out and turn it over. Watch out for fine wires that may run to battery contacts in the case





CLEAN UPPER PULLEYS in same way as lower ones with an alcohol swab. Also wipe the capstan, pinch roller and tape guides. Gently check belt tension

tiny head gaps or they'll clog them. A silicone head lubricant is also available to provide a smooth, gliding surface for the tape. Other aids you can buy include test tapes for checking on various performance characteristics and head-cleaning tapes that do the cleaning job for you. The latter are handy, but should not replace an occasional thorough hand cleaning.

For inside cleaning, you'll need to remove the mechanism from its housing. In some models, the chassis is exposed by removing a cover. In others, the chassis lifts out of the enclosure from the top. Be careful on the more intricate autoreversing and changer models not to damage the delicate machinery. Portable machines are much simpler. Their housings are usually in two shell-like halves. You remove the bottom shell first, exposing the underside of the chassis. Then you take the chassis out of the top shell and turn it over to reach parts on the upper side. Battery contacts are usually in the form of springy clips that can be slipped off plastic posts to free the chassis.

Using swabs and solvent, clean all pulleys, capstans, pinch rollers, spindle hubs, drive belts and other moving parts. Gently check the belts for good tension. Replace any that are loose. Exact replacements can be ordered through hi-fi dealers or the maker of your particular recorder. But don't attempt to open a machine still in warranty as this will void your guarantee. Problems involving extensive repairs are jobs for a trained serviceman. ★★★

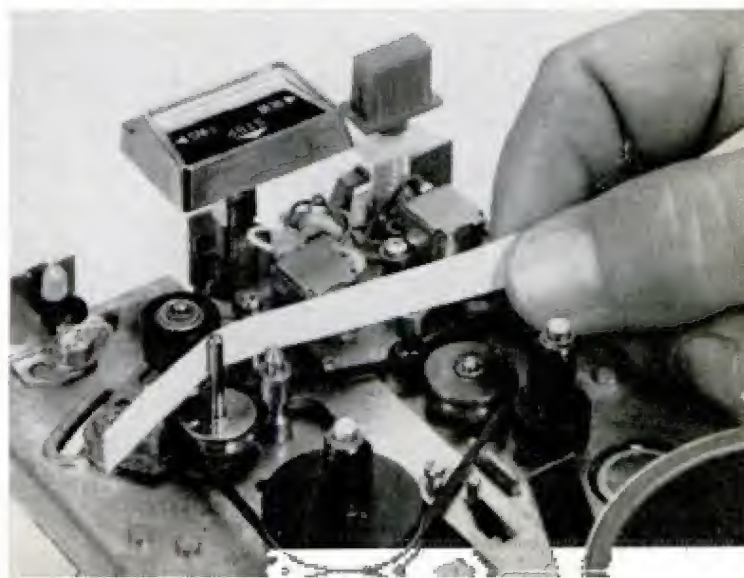
FEBRUARY 1972



HEADS CAN BE CLEANED with special solvent or ordinary denatured alcohol. Wipe them alternately with wet and dry swabs until no traces of dirt remain



PERIODIC DEMAGNETIZING of heads is easy with small demagnetizing tool like Audiotech's above. Tip should just brush past—but not actually touch—each head. Pinch roller should press tape firmly against capstan for smooth, uniform drive. You can check pressure by drawing a thin strip of paper between the roller and the capstan, as shown below





IT'S ONLY A SMALL BOX, but so handy and clever it's a wonder no one thought of it before. It's a walnut-finished minicabinet sized to take the many switches, dimmers, timers and other controls that come mounted on standard wall outlet plates. You just fasten on a plate and have a handsome miniature enclosure. It's shown at left, above, with speaker selector switch and at right with light dimmer for a bed lamp. \$7.95, Audiotex, GC Electronics, Rockford, Ill.

NEW IN ELECTRONICS



A FIRST IN KIT FORM, this cassette recorder is Heath's AD-110, said to match many reel-to-reel recorders in quality. Stereo unit with adjustable bias allows use of new high-performance chromium dioxide tapes, also has pushbutton controls and dual recording meters. Prebuilt transport mechanism and single circuit-board wiring make assembly easy. \$119.95, Heath Co., Benton Harbor, Mich.



YOU CAN NOW BUILD your own four-channel matrixing decoder. The Heath AD-2002 at left is essentially a kit version of the well-known Electro-Voice EVX-4 decoder. The unit, used with two stereo amplifiers and four speakers, provides four sound channels from matrixed two-channel recordings and broadcasts. Price is \$29.95—about half that of ready-made unit. Heath Co., Benton Harbor, Mich.



NOW YOU SEE IT, NOW YOU DON'T: An ingenious "pop-up" control panel on this combination Zenith cassette recorder and AM/FM/FM stereo receiver swings up at an angle for easy accessibility, then retracts out of sight when not in use. A touch of a finger releases the spring-loaded mechanism to raise it for playing. Called the Latham, the stereo unit offers 20 watts per channel, has dual recording-level meters, 12-inch-square speaker enclosures. \$269.95.



STREAMLINED TV ANTENNA has a tiny electronic receiving circuit in a slim, winglike plastic housing only 34-1/8 inches wide. This eliminates the need for long, ungainly arms, yet is said to provide equal or superior signal-grabbing power. Because of its small size, the Stellar 2001 can be used indoors in attics as well as on rooftops. \$75, JFD Electronics Corp., 1462 62nd St., Brooklyn, N. Y. 11219.

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YOU CAN OPERATE the tape recorder below from across the room with a new accessory remote control. The control, designed for use with Ampex's Model AX-300 reel-to-reel recorder, consists of a six-button keyboard on a 15-foot cord that exactly duplicates keyboard functions on the machine itself. The accessory is about \$40; AX-300 recorder, \$649.95. Ampex Corp., Elk Grove Village, Ill.



Ignition timing simplified

By MORT SCHULTZ



The instruments you'll need will pay for themselves in a couple of tune-ups, so go out and get them and start saving money! All the theory you need is in the diagram

YOU HAVE NO CHOICE when timing a late-model car—if you want to do your share in controlling air pollution: Timing must be done by the book to set the optimum point in ignition for maximum combustion and therefore minimum exhaust emissions.

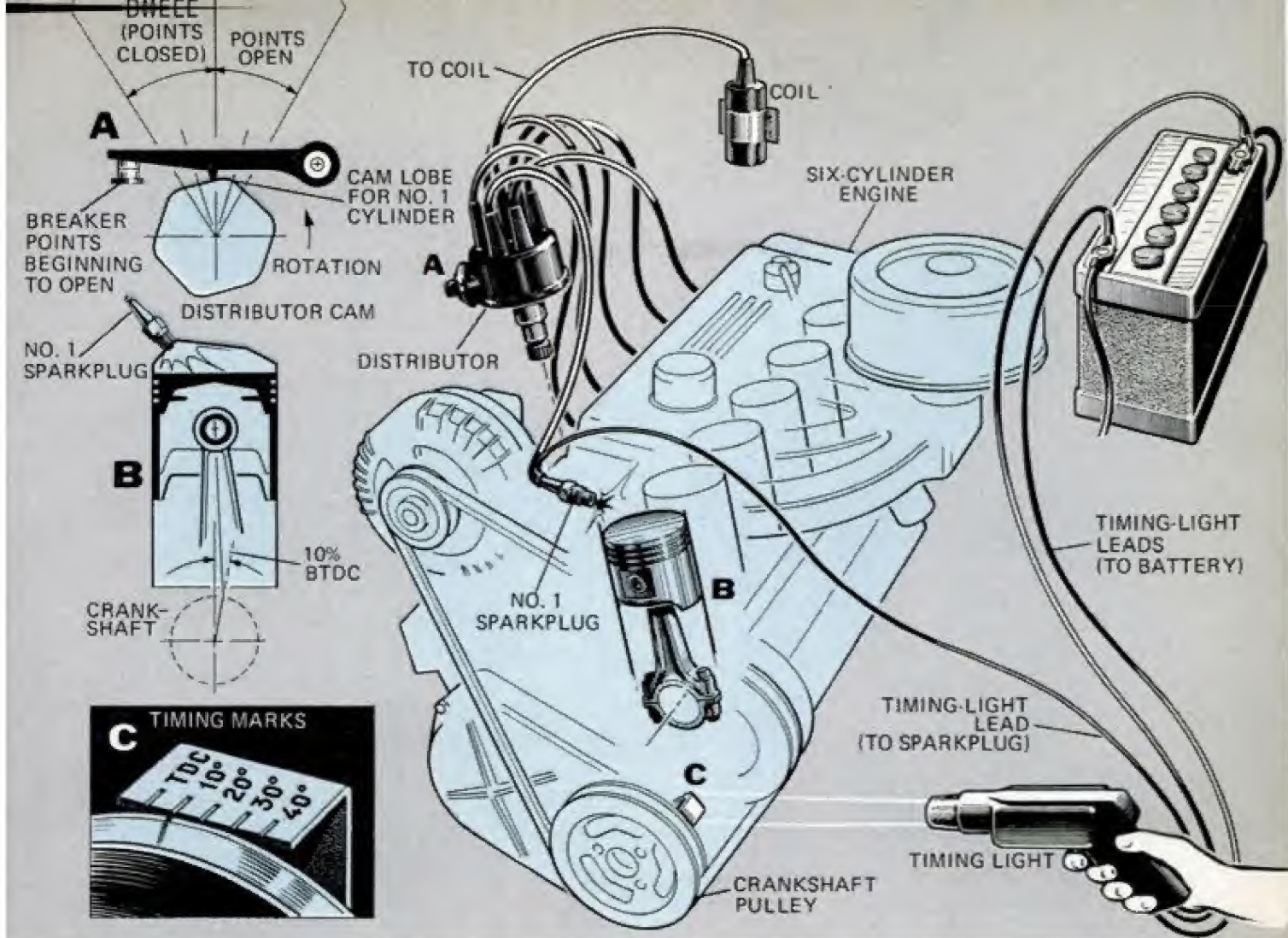
Timing refers to the instant when sparks are delivered to the cylinders for combustion of fuel. Not long ago, it was okay to deviate from manufacturer's specifications. It was common, for example, to advance timing beyond specs so the sparks occurred earlier in the compression stroke—an attempt to get maximum power from the engine.

It's possible to time ignition two ways. Static timing is done with the engine off and a test light connected into the ignition circuit. The distributor is rotated until the test lamp lights

(distributor points open), at which time the distributor is tightened. Static timing specifications, when provided, are frequently given as a range, such as 5° to 10° BTDC. It is very difficult to stop the timing mark exactly on the timing pointer as you turn the engine manually. Today's high-compression engines offer more chance for error due to greater timing-chain or gear lash.

Power timing, on the other hand, done with a timing light, "freezes" a moving timing mark on the crankshaft pulley in relation to stationary marks. The rapid flash of light is initiated at the instant of ignition.

The 1968 and later-model cars with exhaust emission control systems have made timing a new ball game. Engines with pollution-control devices operate generally on a leaner fuel mixture and



INSTANT OF IGNITION—10° before top dead center (BTDC)—is illuminated by a stroboscopic timing light. Action at A (the distributor), B (in the cylinder) and C (at the timing marks) happens simultaneously. As points open, the sparkplug in the No. 1 cylinder fires. At this time, piston is 10° BTDC and timing mark on the crankshaft pulley is opposite 10° mark stamped on stationary indicator. Plug voltage triggers light

a slightly more retarded (later) timing.

Timing an engine to other than manufacturer's specs will upset the effectiveness of the car's pollution-control equipment. According to the research department of Champion Spark Plug Co., "Advancing the timing settings beyond those specified in the manual by the engine manufacturer can result in an increase of from 10 to 30 percent in the emission of unburned hydrocarbons."

You will also upset the fuel-mixture/timing relationship. This can lead to a rough-running engine, unnecessary waste of fuel and damage to sparkplugs.

A power timing light stops the action, so to speak, so that the repetitive sparks occurring in a cylinder appear stationary to the eye. In effect, the eye sees a series of repetitive pulses as one.

The relative position of the timing indicator in terms of degrees of engine rotation is read from the fixed marks on the engine block. By comparing the

position of the timing indicator relative to these marks, you are able to tell where ignition occurs in respect to top dead center of the cylinder being timed.

If your car is a '68 or later model, you will find the timing specification and other pertinent tune-up information on a decal in the engine compartment.

The circuit of a power timing light usually consists of a xenon tube that's connected to a high-energy storage capacitor. To operate the light, you connect it directly to the car's ignition system—normally to the No. 1 sparkplug.

Some voltage given off by the plug as it fires is transferred to the xenon tube, causing ionization in the tube. This permits the tube to conduct energy from the storage capacitor. It's this energy that is converted to the high-intensity light output you see beaming from the light's lens.

For the storage capacitor to function, it must be connected to an electrical



SET POINTS TO SPECIFICATION before timing ignition. Be sure to keep inside of distributor clean

source in one of two ways, depending upon the type of light you have.

With some lights, the energy source for the capacitor is 110 volts a.c. Other types of timing lights have a d.c. circuit that allows you to tap energy directly off the car's battery.

Speaking of cost, power timing lights are priced from \$13 to as high as \$185 for professional models. The most costly are not only better built, but usually combine two or more test instruments.

For example, the Fox Valley Instrument Co., Kal-Equip Co., Simpson Electric Co. and Sun Electric Co. make instruments that combine a timing light with a tachometer and/or dwell meter (degrees advance tester) in a single case.

As I see it, a timing light should have certain features. For example:

- **Brightness.** My light must have a beam intense enough for me to see in daylight. Watch out for timing lights with neon lamps. You may be unable to see the light in anything but a dark room.

Make sure that a timing light doesn't dim out at higher speeds. One thing you'll use it for is to test the functioning of the distributor's mechani-

cal advance. You can't do this if the light dims out at higher rpm (about 2000).

- **Focus.** The only way to determine if focus is right for you is to test the light before buying it. The timing marks should be easy to find with the light. If the beam is too narrow, you will have trouble finding the marks. If the beam is too broad, the intensity of the light will be diminished.

- **Shockproof.** Any light I use has to be shockproof. A car's coil can produce an arc that will jump to the case, and give you a jump, too.

- **Pushbutton on-off switch.** This feature extends the life of the xenon tube, which is expensive to replace. The switch allows you to switch off the light when it's hooked up and not being used.

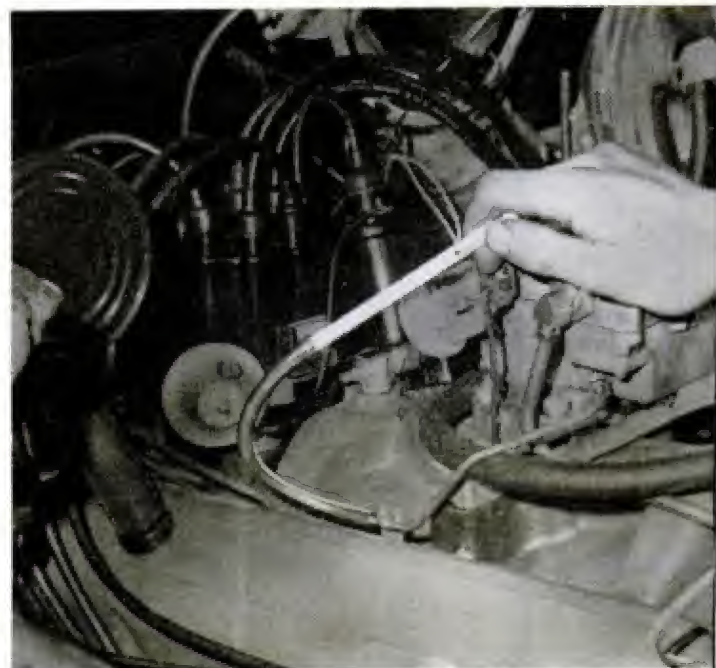
- **Overload protection.** The light should have protection for its circuitry against a surge of high battery voltage and accidental reversing of leads.

- **Solid-state power supply.** For my money, I want a well-designed, solid-state power supply rather than a vibrator type. Solid state is much more reliable.

- **Warranty.** What does the warranty say? How long is it good for and what does it cover? Where must you take the unit if it needs repair and how much will it cost? An instruction book will come with your timing light. However, here are some tips that will help you get full use from the instrument.

Use the light like a pistol. Make sure

BEFORE TIMING IGNITION, on most cars, close spark advance vacuum line. A pencil makes good plug



you sight straight down the beam to the timing mark. Sighting at an angle could throw timing off as much as 3°.

Go by the book. If the manufacturer says to time the car with the engine running at 900 rpm with the spark-advance vacuum line disconnected and closed off, do exactly that.

As we said, tune-up specs are usually attached to a spot beneath the hood. Many owner's manuals also contain these requirements. As a last resort, consult the car's service manual, call a dealer who sells your make of car or write the manufacturer.

Before timing the car, check the distributor point gap and dwell. Dwell angle is the number of degrees through which the distributor points remain closed. If the dwell of your distributor is not to specification, timing will be inaccurate.

So, in addition to a power timing light, anyone doing his own tune-up work needs a tachometer and dwell meter. You can get the details about these instruments (normally combined into one unit) in the February 1971 issue of *PM* (*How to Use the Tach-Dwell for Perfect Tune-Ups*, page 126).

To get a good idea of overall distributor condition, watch the timing marks as you gradually increase engine speed to about 2000 rpm. Excessive flutter means that there is a malfunction, such as bad distributor bearings,

POINT DWELL must be adjusted before timing. This dwell/tach combines both functions in single meter



TYPICAL TIMING LIGHT is pistol-shaped, has on/off trigger. This top-of-the-line model includes built-in dwell tester; some models also include a tach

and the unit should come out of the car for work.

To check out the spark-advance unit, be sure the vacuum line is connected and blip the throttle. The timing indicator should shift rapidly. If not, the spark advance is bad and should be replaced.

If you are working on a V8 engine, after setting timing for the No. 1 cylinder, connect the timing light to the fifth cylinder in the firing order. The timing mark should line up at the same spot that it did for the No. 1 cylinder. In a six-cylinder engine, connect the timing light to the fourth cylinder in firing order after checking No. 1.

More than 3° of variation in timing from one cylinder to the other means that you have a distributor cam or bushing problem.

The following is a list of power timing light manufacturers you can write for data sheets. Specs are good for making comparisons while shopping. Also check auto-parts departments of stores such as Sears, Roebuck. Sears' new line of Penske performance products includes a timing light.

TIMING LIGHT SOURCES

Fox Valley Instrument Co., Cheboygan, Mich. 49721.
Heath Co., Benton Harbor, Mich. 49022.
Kal-quip Co., 411 Washington St., Otsego, Mich. 53140.
King Electronics Co., 9123 Inman Ave., Cleveland, Ohio 44105.
Simpson Electric Co., Automotive Div., 5200 West Kinzie St., Chicago, Ill. 06644.
Snap-On Tools Corp., Kenosha, Wis. 53140.
Sun Electric Corp., Harlem and Avondale Aves., Chicago, Ill. 60631. ★★ ★

New tools for tune-ups and



SPARKPLUG FIRING INDICATOR that can help locate a misfire on any engine is about the size and weight of a ballpoint pen and has a small neon tube built in its case. When a sparkplug fires, there should be a bright flash in the tube. When a weak spark (or no spark) occurs, the flash will be dim.

Intensity and frequency of flashes point out various ignition conditions: 1. Single brilliant flashes occurring each time the plug fires indicate normal ignition and full voltage buildup; 2. Uneven intensity of flashing as speed increases indicates possibly faulty breaker points, coil, condenser or cable con-

nections; 3. Weak flashing becoming intermittent as speed increases indicates a partly fouled plug; 4. Very weak, uniform flashing indicates complete fouling; 5. Extra flashes between main firing flashes indicate voltage induced from nearby ignition cables.

As you move the indicator along the ignition cable and around coil and distributor towers, very weak flashing indicates a normal condition; bright flashing at the point passed, a faulty insulation or broken element in resistor-type cable. Made by Champion, the inexpensive CT-436 indicator is available wherever its sparkplugs are sold.—*Bill Neumann*



POINT DWELL AND IGNITION TIMING can be done quickly without running your engine. Compu-Dwell consists basically of an on/off lamp and a magnetic compass. Opening and closing of your car's ignition points turn the lamp on and off, and when you rotate the distributor, the compass measures dwell angle. Much more sophisticated and expensive instruments do these things, but in general, none is more accurate. To time your engine with Compu-Dwell, you first set the timing pointer (on the engine vibration damper or crankshaft pulley) to the specified mark. Then loosen your distributor with the Compu-Dwell in place, rotate the distributor until the lamp goes off and retighten the distributor.

To measure dwell angle, you first turn the distributor until the lamp just lights. Then you set the compass on zero. It's an ordinary magnetic compass, but it's calibrated in degrees of dwell instead of in N-S-E-W. Now turn the distributor again until the lamp goes off. Degrees of rotation will show on the compass face. This is your dwell angle; if not to spec, you simply adjust the points setting. Retail price is \$14.95. Compu Industries, 932A North Brand Blvd., Glendale, Calif. 91202.

—*Mike Lamm*

troubleshooting

SEE-THROUGH SPARKPLUG lets you see into the cylinder while your engine is running. The test plug replaces your normal sparkplug while you do a tune-up by watching the color of combustion in the cylinder. After installing the Colortune 2, connecting your spark-plug cable to the tungsten electrode and starting the engine, look straight down at the plug through the special Borosilicate glass into the cylinder. Since gasoline and air mixtures burn at known colors depending on the fuel/air ratio, you can determine how lean or rich your carburetor mixture is. Very lean mixture burns with a whitish-blue color, which becomes more intense as mixture is richened. At maximum engine power the flame becomes Bunsen blue, an intense light blue. Richer mixtures burn with increasing orange tinge in the blue until flame is all orange and then all yellow. Point of maximum economy is intense whitish-blue, which is just a little lean from the Bunsen-blue maximum power point. The Colortune 2 can also troubleshoot other engine functions and is perfect for dual carburetor setups. Comes with necessary adapters and a cleaning kit. Price is \$15.50. Write: Donald W. Abercrombie, Import-Export, Box 632, Oak Ridges, Ontario.—B. H.



TUNE-UP MICROMETER KIT can measure piston position in cylinders of two or four-cycle engine. Designed for small engines on motorcycles, snowmobiles, lawn mowers and other recreational vehicles, the kit includes a micrometer and continuity tester with lead and alligator clip. Micro-Time is inserted in the sparkplug hole and a sliding rod extends to touch the top of the piston. The piston

is positioned at the required specification by reading the micrometer markings on the barrel of the unit. The continuity tester is attached to the points to set timing. The unit fits 10, 12, 14 and 18-mm sparkplug holes and can be used on magneto or distributor-type engines. Retail price is \$15.95. Compu-Industries, Inc., 932A North Brand Blvd., Glendale, Calif. 91202.—B. H.

EXCITING NEW PRODUCTS

BY CATHERINE BILSKI



THIS TELEPHONE AMPLIFIER eliminates the need for being "chained" to the telephone while you are working or waiting for your party to answer. Once connected to the phone you simply turn up the volume; anyone in the room can hear both sides of the conversation. Ideal at home or for those conference calls at the office. \$9.95 from Wolleys of St. Petersburg, 5200 Joe's Creek Drive N., St. Petersburg, Fla. 33709.



THOSE MENDING REPAIR JOBS can be quickly and easily bonded with a superglue called Pow'r Grip. It's quick setting, has high water resistance, excellent bridging performance and there's no mixing or waiting for curing. It can be used effectively on glass, wood, paper, cloth, brick, veneer, metal and most plastic. A 2½-oz. tube sells for \$1.25. The H.B. Fuller Co., 2400 Kasota Ave., St. Paul, Minn. 55108, is the maker.



PROTECT YOUR CLOTHES while painting, cleaning, gardening, whatever, by wearing the Protector Coverall. Made of 100 percent Tyvek fiber from Dupont, it's water, acid and tear-resistant, strong even when wet, and reusable. Handy when kept in the car for use in case of engine trouble or flats, it retails for about \$2. The manufacturer is Bulkley Dunton Linde Lathrop, Inc., 295 Fifth Ave., New York, N.Y. 10016.



WHILE YOU'RE AT HOME OR AWAY the Mark-Time Timed Extension Cord provides automatic preselected time-control "shutoff" for TV, radio, lamps, fans and other electrical household devices. Just turn the knob to the time period you want (up to four hours) and a switch will turn off the electricity at time selected. For use as ordinary extension cord, set knob at "manual"; \$8 from M.H. Rhodes, Inc., 99 Thompson Rd., Avon, Conn. 06001.



PRACTICE TENNIS by yourself. With the Wonder Tennis Trainer you don't need a partner and because the ball is attached to an elastic cord for self return, there's no chasing it. The \$7.95 device, which helps improve your serve, coordination, grip, balance and stroke, can be used at home, on a tennis court or playground—wherever there's room. General Home Products Corp., 745 Salem Rd. at Route 130, Burlington, N.J. 08016.



BUILT LIKE A BICYCLE ON SKIS, the Wooster Sno-Bob is a thrilling new ride for winter fun. It's so easy to handle that even a first-time rider can race it down hills or make lazy loops in the snow simply by turning the handlebars and leaning into the turns. The front ski floats through a 60° arc to slide over bumps and provide steering control. Made by Wooster Ltd., Div. of Rubbermaid, Inc., Wooster, Ohio 44691, it retails for \$39.95.



PACEMAKER PROTRACTOR is a multiple use space-age instrument designed to give fast, accurate angle construction details and measurements. It has a full 360° floating rotor (easily removed for compass action), with 4-inch ruler, finger lifts, wraparound metric and inch rulers, circle and arrow symbol templates. Retail price is \$1.95, from Frey Educational Research, Inc., 7434 Craigmere Dr., Cleveland, Ohio 44130.

FEBRUARY 1972



PUT AN END to scraping and time-consuming defrosting of your ice-covered car windshield with Hot-Melt De-Icer. You simply spray your windshield and hot de-icing fluid immediately goes to work removing ice and snow. It's claimed to be safe for all auto finishes, wiper blades and glass, also to work great on frozen fuel lines, locks and door handles. Can retails for \$2.29, is manufactured by Aeroseal Corp., Box 308, York Haven, Pa. 17370.

123



A modelmaker's 'workshop' in a cabinet

By RUDY KOUHOUP

Photos by Robert D. Borst

IF YOU NEED a good place to work on miniature engines, models or other small projects, this neat little cabinet will fill the bill nicely. It's an efficient and inexpensive (it cost me about \$27) cabinet workshop that takes up just $3\frac{1}{2}$ sq. ft. of floor space and provides a place for everything. And your metal lathe, vise and large tools can be stored in the roomy bottom compartment between work sessions. Fourteen shallow drawers place all hand tools, lathe accessories and measuring devices at your fingertips. You will have more than enough bench space when you raise the hinged drop leaf to obtain the full 17 x 44-in. work surface.

All members of the cabinet are cut from $\frac{1}{2}$ -in. A-D plywood and are fastened

together with glue and brads. Start with the sides which are $16\frac{3}{4}$ x $26\frac{1}{2}$ -in. Dado the sides 7 in. from the bottom so the shelf will be well supported. Scribe and cut the sides to clear your baseboard when the cabinet is against the wall. Fasten the 16 x $29\frac{1}{4}$ -in. shelf in the dados in the sides and use a length of dowel in front to give center support to the shelf.

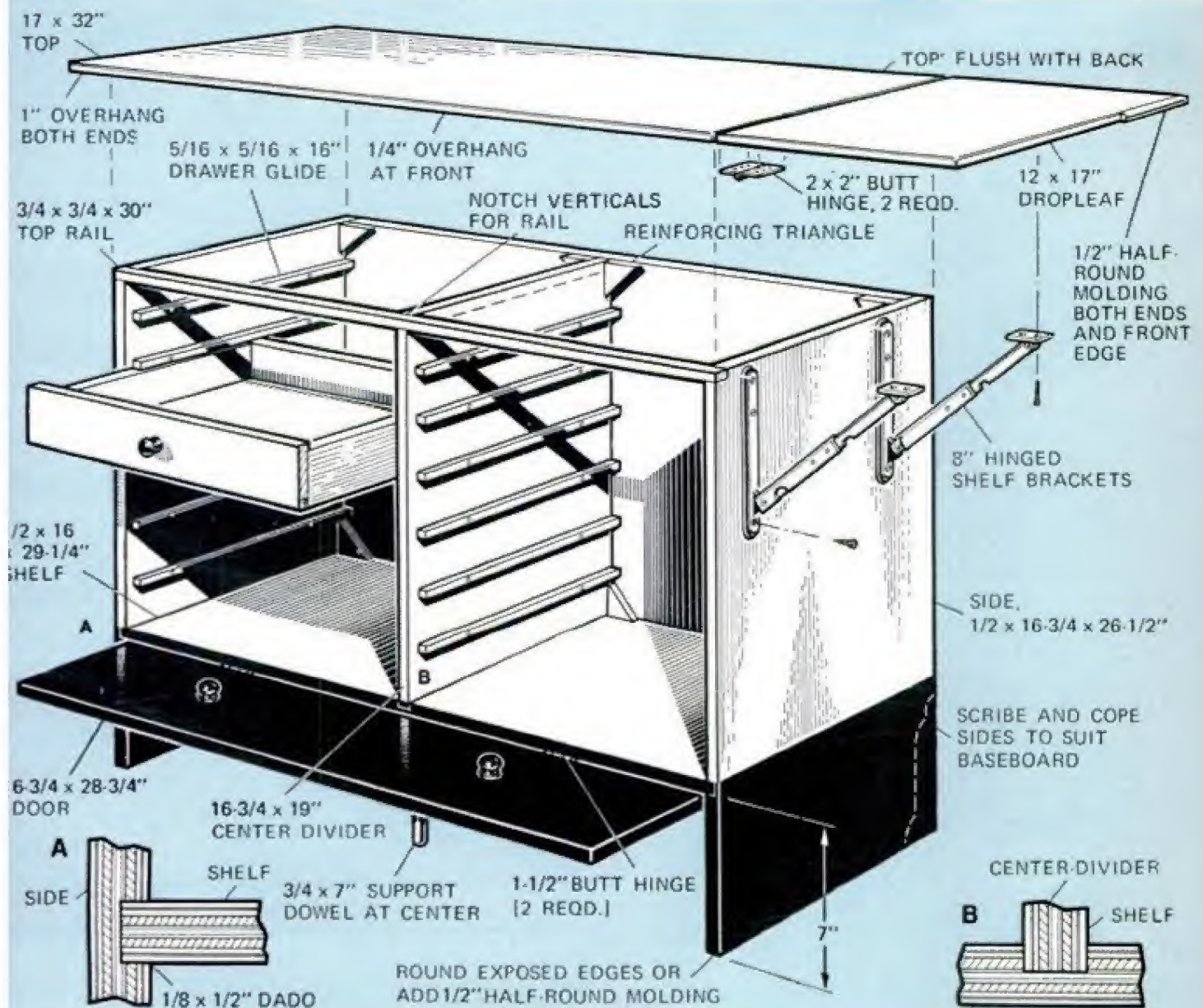
The center divider is attached to the top of the shelf. Cut a piece 17 x 32 in. for the top. Put it in place nailing into the sides and center divider. Use a 4-in. triangle of $\frac{1}{2}$ -in. plywood at each corner in the rear to reinforce the shelf, sides, top and center divider.

Cover the exposed edges of the plywood with $\frac{1}{2}$ -in. half-round molding for ap-



IF FINISHED NEATLY, your cabinet workbench will look well in any room that you want to keep it

SMALL TOOLS and lathe accessories are at hand in shallow drawers. Use thin wood for partitions





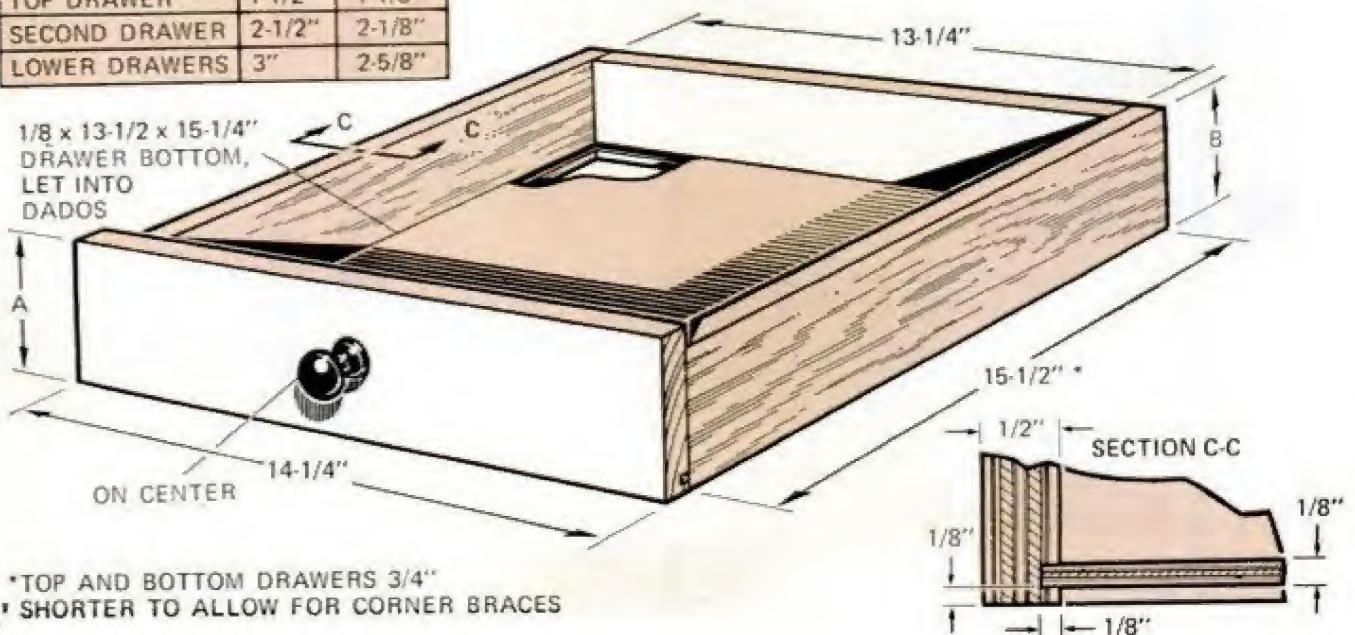
SMALL PERRIS LATHE (18½ in. long) is quickly and easily stored out of view behind the hinged door



DRAWER CONSTRUCTION is simple as shown in drawing below. Partitions suit the owner's tools

| | A | B |
|---------------|--------|--------|
| TOP DRAWER | 1-1/2" | 1-1/8" |
| SECOND DRAWER | 2-1/2" | 2-1/8" |
| LOWER DRAWERS | 3" | 2-5/8" |

1/8 x 13-1/2 x 15-1/4"
DRAWER BOTTOM,
LET INTO
DADOS



*TOP AND BOTTOM DRAWERS 3/4"
* SHORTER TO ALLOW FOR CORNER BRACES

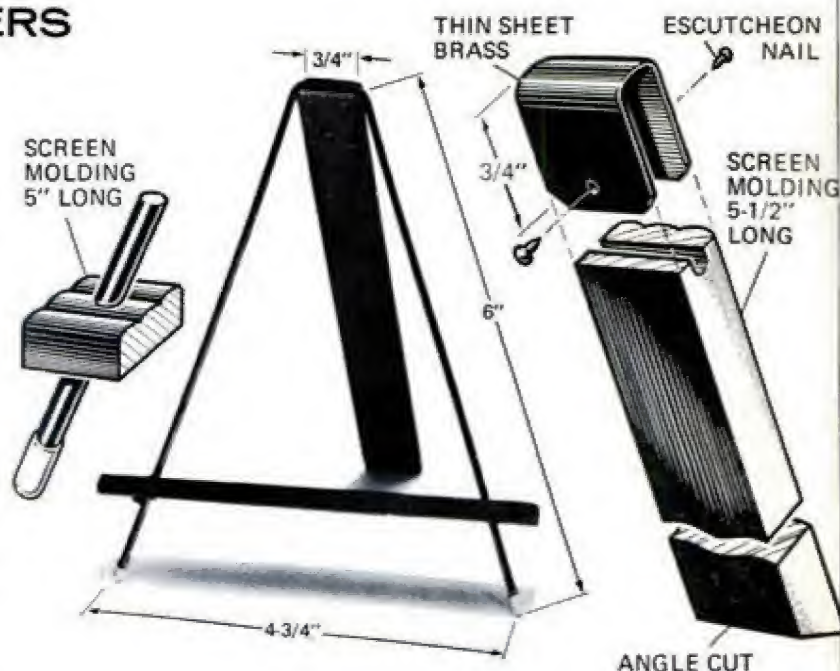
pearance. Rip 5/16-in.-sq. strips to use as drawer slides on the sides and center divider. Fasten the strips with glue and brads.

The drawer sides, fronts and backs are also cut from 1/2-in. plywood with a 1/8 x 1/8-in. groove dadoed in 1/8 in. from the lower edge to receive the bottoms. Take drawer dimensions from the cabinet. Assemble the drawers and drill the fronts for the knobs. Add partitions and dividers to the drawers to suit your lathe accessories and tools.

Use butt hinges to attach the door to the bottom shelf so it swings down to close the large bottom compartment. Use 8-in. folding shelf brackets and another pair of butts as shown to attach the drop leaf. Put 1/2-in. half-round molding around the top and drop leaf. If you have the space, a drop leaf could be fitted to the other end also. Cover the top and drop leaf with plastic laminate. The cabinet receives a coat of enamel undercoater followed by a durable semigloss enamel.

Modelmakers who build engines and similar projects will require the use of a small metal-cutting lathe. The one shown is a British lathe built by Perris Engineering Ltd. and imported by Caldwell Industries, Box 170, Luling, Tex. 78648. It sells for \$300. A full range of accessories is available for this back-gear, screw-cutting lathe which measures just 18½-in. long. It is capable of handling a workpiece 9-in. long between centers and has a 4¾-in. swing in the gap and a 3½-in. swing over the bed. ★★★

HINTS FROM READERS



Miniature easels easily made from screen molding, sheet brass and wire

Having need for a dozen or more small easels to hold nameplates and postcard paintings, I mass-produced them from screen molding, coathanger wire and sheet brass. Holes for the wire are made a tight fit, and the support leg is hinged with a U-shaped clip so that the leg can be adjusted to the desired angle. When not in use, the easels can be folded flat.

—Henry Stainken, Staten Island, N. Y.



Substitute for layout dye

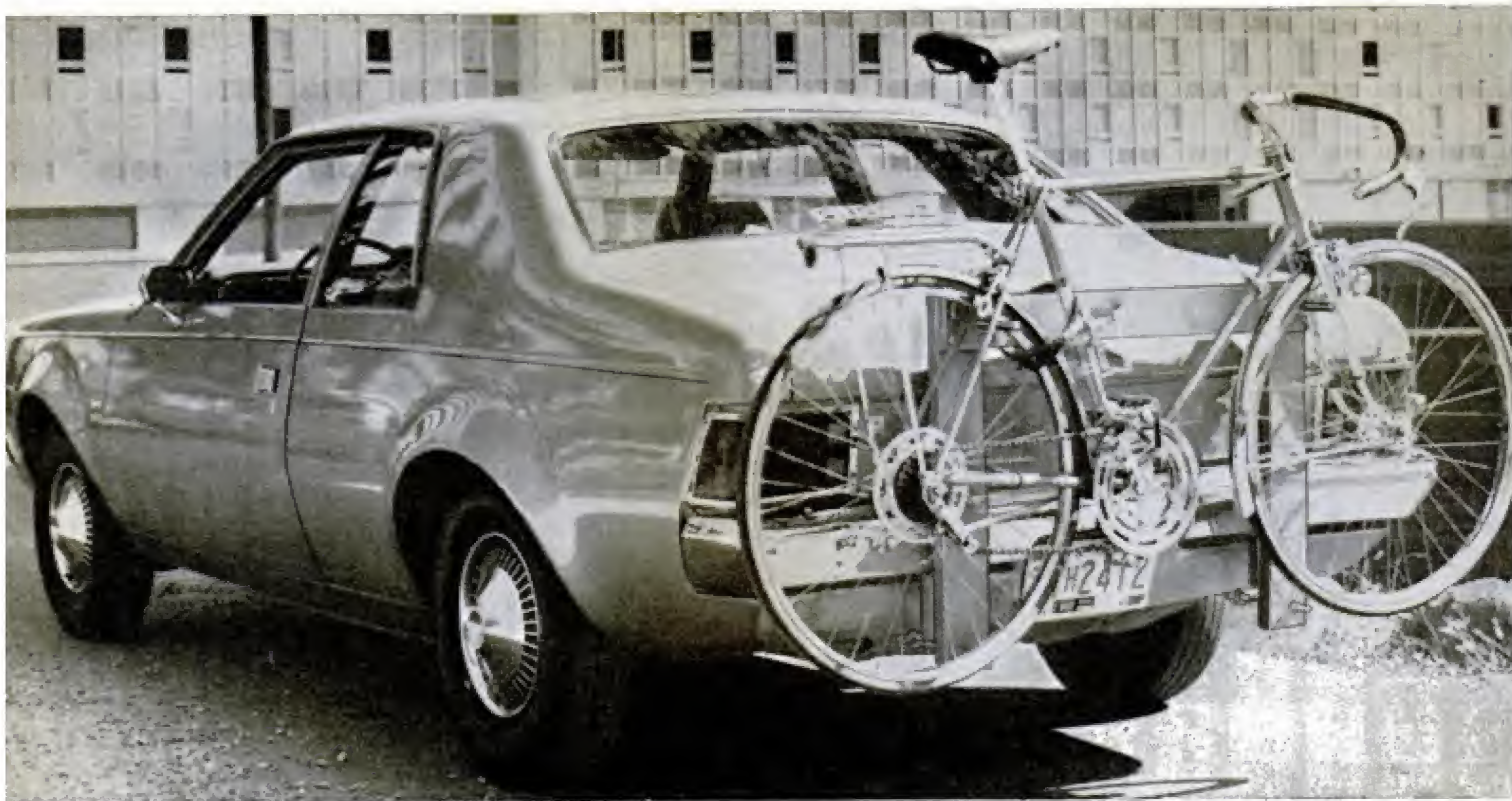
For an occasional job of marking and scribing metal, I have found that a felt-tip marking pen makes a good substitute for regular layout dye. You can scribe it when it dries and it wipes off easily with a lacquer thinner.

—Doug Blodgett, St. Charles, Mo.

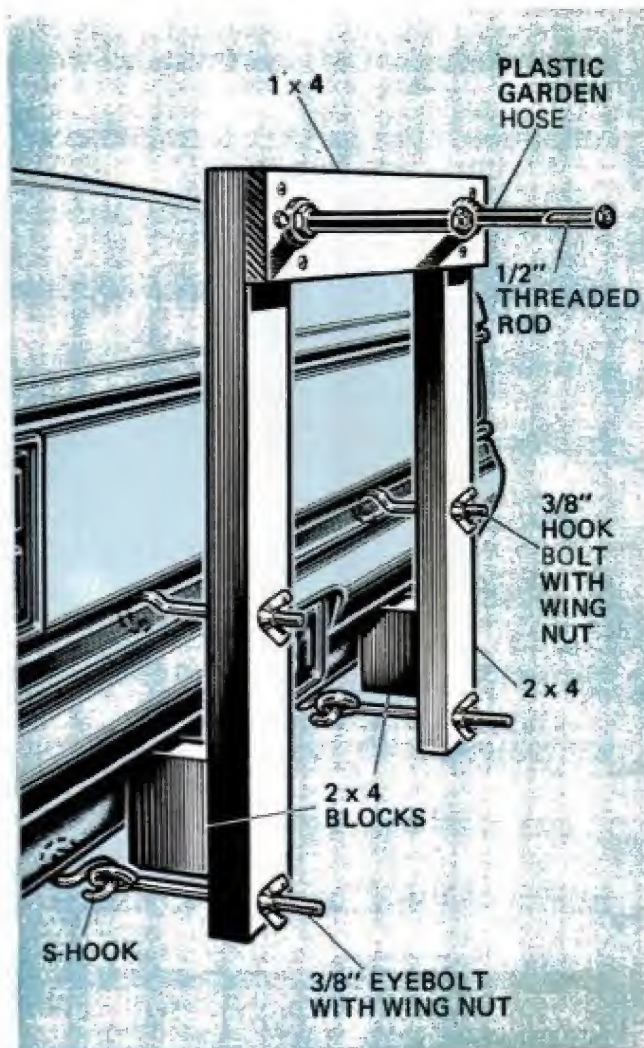


Support for tall potted plant

A philodendron grew so tall that supporting it became a problem; soil in the pot wouldn't hold a stake. I welded three metal rods (one 24-in., the others 12-in.) to an 8-in.-dia. steel plate as shown above, removed the plant from the pot, put the welded affair in the bottom and repotted the plant. I stuck lengths of bamboo fishing pole over pointed ends of the rods and changed to longer lengths as the plant grew.—G. H. Willard, Seattle.



Car-bumper bike rack



WITH A RESURGENCE in bicycling interest, you often see people carrying bikes—usually stuffed in the trunk with the lid tied down—to the local repair shop or with them on a vacation trip.

To make it easy to carry a bike, I decided to make the rack shown above. Its simplicity of design lets you attach the sturdy carrier to the rear bumper without using any tools. It consists of two uprights, a 1x4 crosspiece and about \$4 worth of hardware. The exact dimensions will depend upon the car and the style bike to be hauled.

The crosspiece is fastened to the uprights with glue and screws. Then the carrier is secured and supported by two hook-bolts that pass through the uprights and hook over the bumper. Wood blocks must be fastened to the bottoms of the uprights. These bear against the lower part of the bumper and can be contoured if desired. The lower hooks catch behind the rear sheet metal or lowest edge of the bumper. The hooks are a combination of an S-hook, long eyebolt and wingnut. Clinch the S-hook so it won't get lost. The bike is supported under its wheel rims by the two studs at top. Lash it in place using straps and a lock.—Peter F. Dexter

HINTS FROM READERS

'Bell clapper' helps cut bottle

A steel ball swinging on a cord, like a clapper, can be used to cut a bottle neatly in two. Solder a wire loop to a $\frac{5}{8}$ -in. cold-rolled steel ball and affix a length of cord to the loop. Fasten the other end to a cork that fits the bottle. After scoring the bottle outside with a glass cutter, gently swing the ball so it strikes the mark.

—B.W. Ervin, Kent, Ohio



Taper reamer eases pipe taps

Next time you have to tap through-holes for $\frac{1}{8}$ or $\frac{1}{4}$ -in. pipe threads, try this stunt for surer starts and deeper cuts, with resulting leakproof joints. Start by reaming the holes lightly with a taper reamer, but be sure to ream only three or four threads deep since the taper will not match exactly the taper of the pipe threads. I've used the idea often with great success. It should work for anyone after a little practice.

—John F. Pilznienski, Dearborn Heights, Mich.



Holding hasp open

Often, when a toolbox is kept locked with a padlock and hasp, the latter can be quite a nuisance when you want to keep the box open. Just turn a screw eye in the lid to hold the hasp leaf out of the way. A quarter turn releases it.

—Jim Rudd, Chicago.



Plastic weights

Neat weights for counterbalancing a mechanism or powering a clock can be made from plastic tumblers with tight-fitting caps. Drill two holes in the bottom for a wire staple and anchor it with concrete.—Walter E. Burton, Akron, Ohio.



Slowing setscrew slip

When a setscrew bears against a flat area on a shaft it may be better not to run the flat all the way to the end of the shaft, especially when the assembly runs in a vertical position, as with the drill press shown.—W. B. May, Oak Park, Ill.



Big banger from Suzuki is water-cooled!

Quiet and quick, the GT-750J Le Mans gets its go from three cylinders displacing 750 cc. Instant Japanese punch—just add water!

By JOHN ETHRIDGE

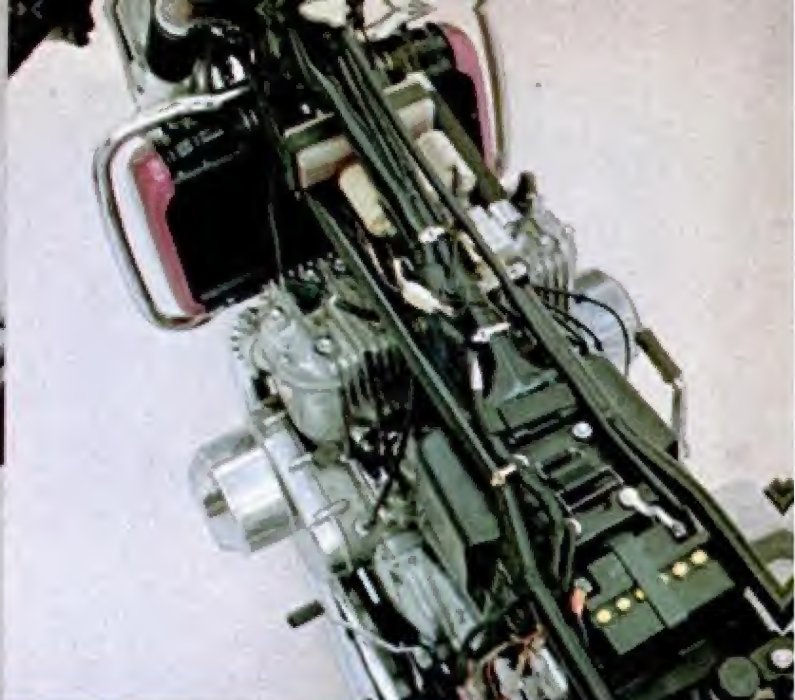
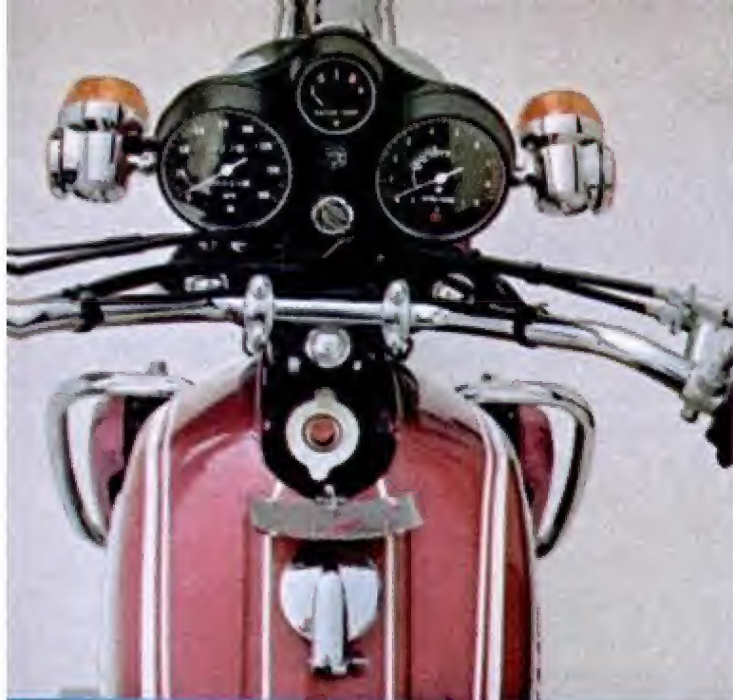
Photos by David Gooley



SUZUKI'S CHARGE into the superbike field with a water-cooled two-stroke promises to make waves for some time. Anyone remembering Suzuki's 50-cc water-cooled, two-stroke Grand Prix machines will agree that if you want the maximum power possible from a given-size engine, this is the way to go. The last of these produced a reliable 19 hp—better than 6 hp per cubic inch—in the region of 20,000 rpm!

The nature of two-strokes is such that by "stuffing" the crankcase for increased supercharge and altering the ports and exhaust tuning to move the power higher on the rpm scale, seemingly endless increases in power can be obtained. But with an explosion at the top of every stroke and every downward stroke a power stroke, overheating becomes the limiting factor. It's been tried with air-cooled two-strokes, but when taken too far results in a "Dixie cup" engine—the kind you use once and throw away. But with efficient water-jacketing and a radiator, demon heat is dissipated, lowering operating temperature and leaving room for power increases.

In the case of the Suzuki GT-750J Le Mans (doubtless too much of a mouthful for even a bike of this stature), lowering the operating temperature was more of a design objective than was a large power increase. Suzuki claims it runs 30-percent cooler than any air-cooled motorcycle engine, which is quite believable. On the average, it took 15 minutes of running before the thermostat opened and the radiator became warm to touch. But the surest indication that water cooling vastly changes the nature of a two-stroke came



RADIATOR CAP hides under flip-up flap on front end of the four-and-a-half-gallon fuel tank. The five-quart radiator is prominent but protected by sturdy chromed crash bars. Water-temperature gauge is above the tach and speedo. Battery and electrics are packed under the saddle. Small expansion tank for radiator is just behind the radiator filler neck





DUAL FRONT BRAKE is actually two brakes on a common drum. We'd prefer an efficient, simpler disc

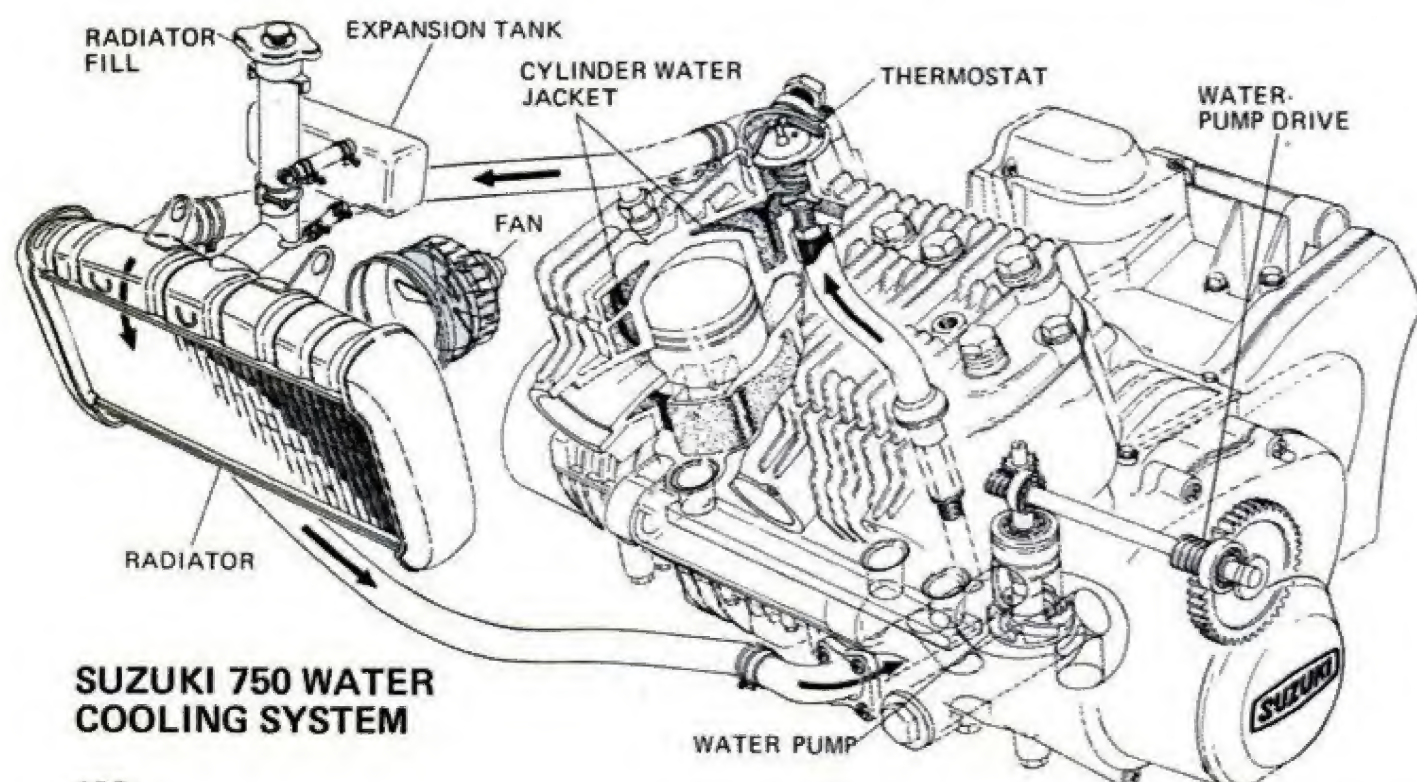
during the acceleration test. Contrary to the usual case, the cool-head "Zuke" got *faster* after a few runs, with the best times always coming after at least three trips through the quarter-mile in quick succession. The thermostatically controlled electric fan never came on during any phase of the test, and according to a Suzuki mechanic, it takes 45 minutes of idling in a closed room to make it come on. This bodes well for desert or mountain touring as well as any future power increases deemed necessary.

As it is, the GT-750 has power to spare for any situation. Wondering where the power would come in ceased as soon as the throttle was cracked a few degrees. It's right there, and smoothly increases as the tach needle wipes the face until the mid-6000 point, marking this engine as a low-ender, which was surprise No. 1.

No. 2 was the eerie quietness of the blatant-looking quartet of exhaust pipes as the engine wound out to redline. This bike is a whoosher, not a screamer, and will appeal to those who like to speak quietly and carry a big stick. It's possible to grab large handfuls of throttle accelerating away from traffic signals and get all of the performance, short of wheelspin, the engine is capable of delivering without attracting attention. The three exhaust headers are interconnected just ahead of where the center one branches into two pipes, neatly combining efficiency, noise abatement and symmetry.

Surprise No. 3, perhaps the nicest of all, was the smoothness and lack of transmitted engine vibration throughout most of the rev range, particularly at cruising speeds, ranking this machine with the best on the road in this regard.

Handling on twisty roads is very acceptable for a bike of this weight, but you can't lean it over to the tire tread limit because the kickstand or the pipes drag. Also, the front brakes—actually two brakes acting on a common drum—really aren't up to this sort of thing. The brakes,



SUZUKI 750 WATER COOLING SYSTEM

however, are adequate for touring, which is what the bike was designed for.

The center of gravity is quite far forward. When on the center stand, it takes a hefty person astride the rear of the saddle to bring the front wheel off the ground. With this weight distribution, you have to try hard to pop a wheelie and there is a strong tendency toward wheel-spin getting off the line. Slipping the clutch quite a bit so there was little or no wheelspin netted the best acceleration times.

Robust engines call for robust clutch spring pressures, but force required to operate the clutch lever wasn't as brutal as you might expect, considering the

torque it has to handle. Only in stop-and-go traffic did the left hand get a bit tired. Finding neutral on the foot shift proved to be the easiest of any bike we've ridden because of the rather long throws between it and first and second speeds. But for the same reason it's necessary to remember to toe the lever good and hard on the upshift from first to second or you'll often find yourself in neutral.

Another thing to remember about this and other Suzukis is never leave the fuel cock in the "prime" position any longer than it takes to fill dry carburetors or there is risk of fuel getting in the crankcase and creating a hydra-lock. There is

(Please turn to page 178)

SUZUKI GT-750J LE MANS SPECIFICATIONS



PROFILE OF BIKE reveals a center of gravity that is farther forward than that of most 750s. Center exhaust header of three-cylinder machine splits into two for symmetry of two pipes on either side of motorcycle

PERFORMANCE

Quarter-mile acceleration:

| | |
|-------------------------|-------|
| Elapsed time, sec. | 13.23 |
| Speed, mph | 100 |
| Top speed, mph | 115 |

ENGINE

| | |
|-------------------------------|----------------------------------------------|
| Type .. | water-cooled, 3-cyl., 2-stroke, piston valve |
| Bore and stroke, in. (mm) .. | 2.76 x 2.52 (70 x 64) |
| Displacement, cu. in. (cc) .. | 45 (738) |
| Compression ratio | 6.7:1 |
| Horsepower @ rpm | 67 @ 6500 |
| Torque, ft.-lb. @ rpm | 55.7 @ 5500 |
| Ignition system | battery, triple coils and points |

TRANSMISSION

| | |
|-----------------------------|--------------------------------|
| Type | 5-speed, constant mesh, return |
| Pattern | 1-N-2-3-4-5 |
| Internal ratios: | |
| 1st | 2.846 |
| 2nd | 1.736 |
| 3rd | 1.363 |
| 4th | 1.125 |
| 5th | 0.923 |
| Reduction ratios: | |
| Primary | 1.673 |
| Final | 3.133 |
| Overall (in top gear) | 4.84 |

| | |
|-----------------------------------|-----------------|
| Mph per 100 rpm in top gear | 16.0 |
| Clutch | wet, multiplate |

FRAME AND SUSPENSION

| | |
|------------------------|-----------------------------------|
| Front suspension | telescopic, 2-way |
| Rear susp. | swingarm, adj. 2-way spring/shock |
| Frame | double cradle tubular steel |

WHEELS AND BRAKES

| | |
|---------------------------------------------------|-----------|
| Tire size, front | 3.25-19 |
| Tire size, rear | 4.00-18 |
| Brakes, front, drum, 2-panel, double leading shoe | |
| Brakes rear | drum |
| Brake size, in., front | 7.75 dia. |
| Brake size, in., rear | 7.00 dia. |

DIMENSIONS AND WEIGHT

| | |
|------------------------|------|
| Length, in. | 88.5 |
| Width, in. | 33.0 |
| Height, in. | 45.0 |
| Wheelbase, in. | 58.2 |
| Test weight, lbs. | 526 |

CAPACITIES

| | |
|---------------------------------------------|-----|
| Fuel, gal., including .5-gal. reserve | 4.5 |
| Engine oil, qts. | 1.9 |
| Gearbox oil, qts. | 2.3 |
| Coolant, qts. | 5.0 |

| | |
|-----------------------|--------|
| PRICE AS TESTED | \$1575 |
|-----------------------|--------|

Cook where the fun is...

... in living room or family room with this portable electric grill. A 'porthole' in the outside wall vents cooking odors outdoors

By WAYNE C. LECKEY, Home and Shop Editor

Photos by Robert D. Borst



HIDDEN UNDER FOLD-OVER TOP, grill masquerades as handsome piece of furniture when not being used

FOR PERMANENT INSTALLATION, grill can be placed in your kitchen counter (see page 152, Dec. '70 PM)

WHEN YOUR GUESTS are having a ball and you're slaving over a hot stove in the kitchen, entertaining friends is not all fun. With this electric grill-on-wheels the host can join the fun from the start and charbroil mouth-watering steaks right in the center of the party.

The drop-in grill is the same one we told you about earlier (See *Now: Cookout Fun Indoors Anytime!*, page 152, Dec. '70 PM), only this time you install the grill in a smart roll-about cabinet (which we show you how to build) rather than in a kitchen counter.

To enjoy this exciting, modern indoor cooking, you roll the cabinet up to a "porthole" in an outside wall, connect the grill to it with a 24-in. flexible duct and plug the cord into a 240-v. outlet. In seconds you have 2800 watts of clean radiant heat which will charbroil steaks, hamburgers, hot dogs, fish or fowl faster than an outdoor grill. A powerful below-the-surface fan pulls smoke and fumes directly into the exhaust system without a trace in the room.

The grill is made by Jenn-Air Corp., 3035 Shadeland Ave., Indianapolis, Ind. 46226, and has a suggested retail price of \$235 at Jenn-Air dealers. (It may be slightly higher in some areas.) Besides including a cast-aluminum nonstick griddle, the grill features a lighted fan switch and grill pilot light, a built-in timer and a convenience outlet.

There are several gourmet accessories you can add, including a rotisserie, shish kebab and french fryer. A kit of parts for wiring and ducting the grill outdoors is

YOU CAN HAVE GUESTS over for a "cookout" in the middle of winter with this elegant flip-open grill. When vented outside and plugged in as shown at the right, you can char-grill succulent steaks indoors in a party atmosphere without smoke or cooking odors

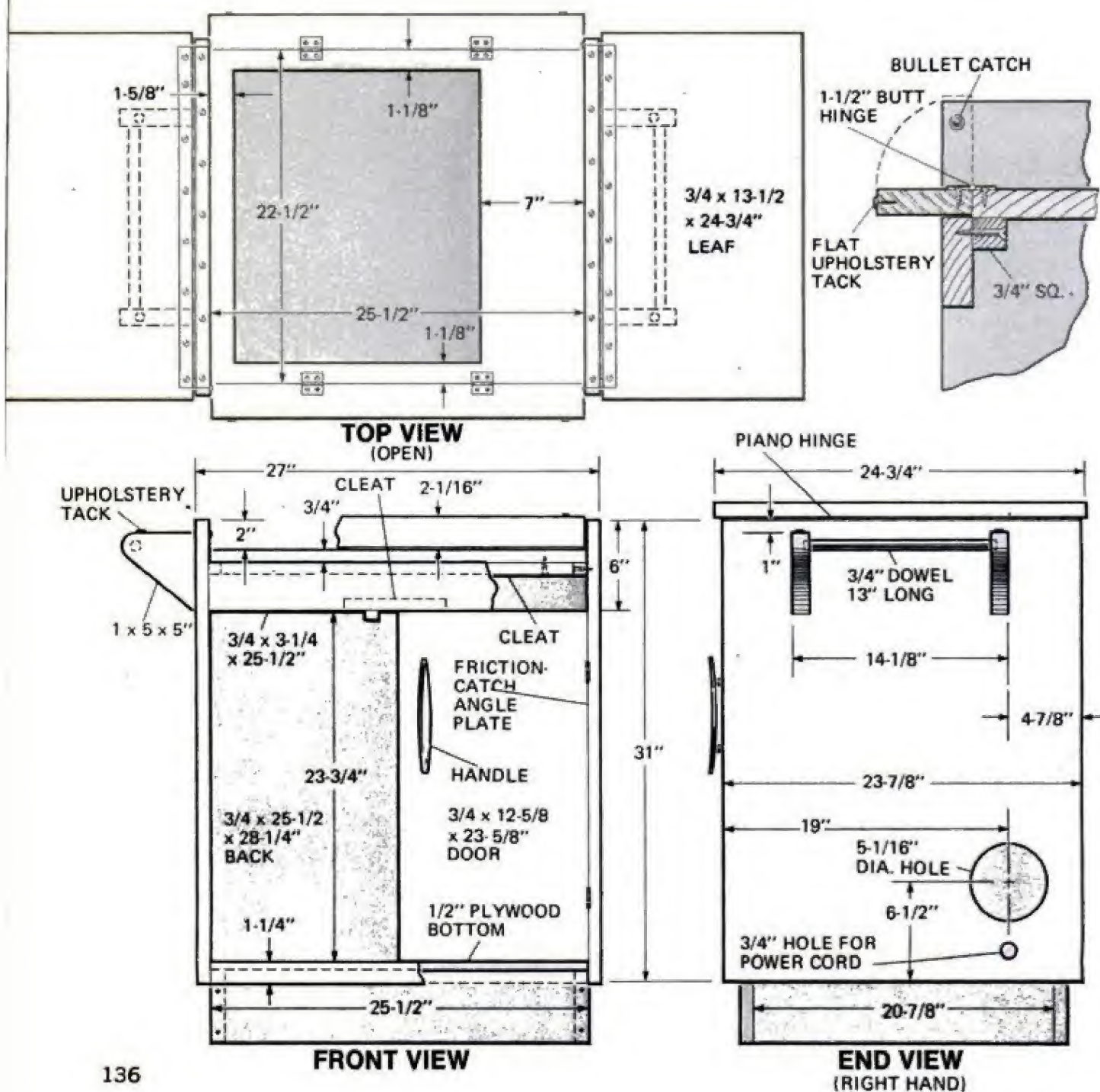
POPULAR MECHANICS







SNUG-FITTING CAP (above) plugs duct hole in cabinet when grill is not used. Interior view (right) shows how the grill blower is piped outside of cabinet with two 5-in.-dia. galvanized furnace-pipe elbows



available from Jenn-Air for \$23 postpaid.

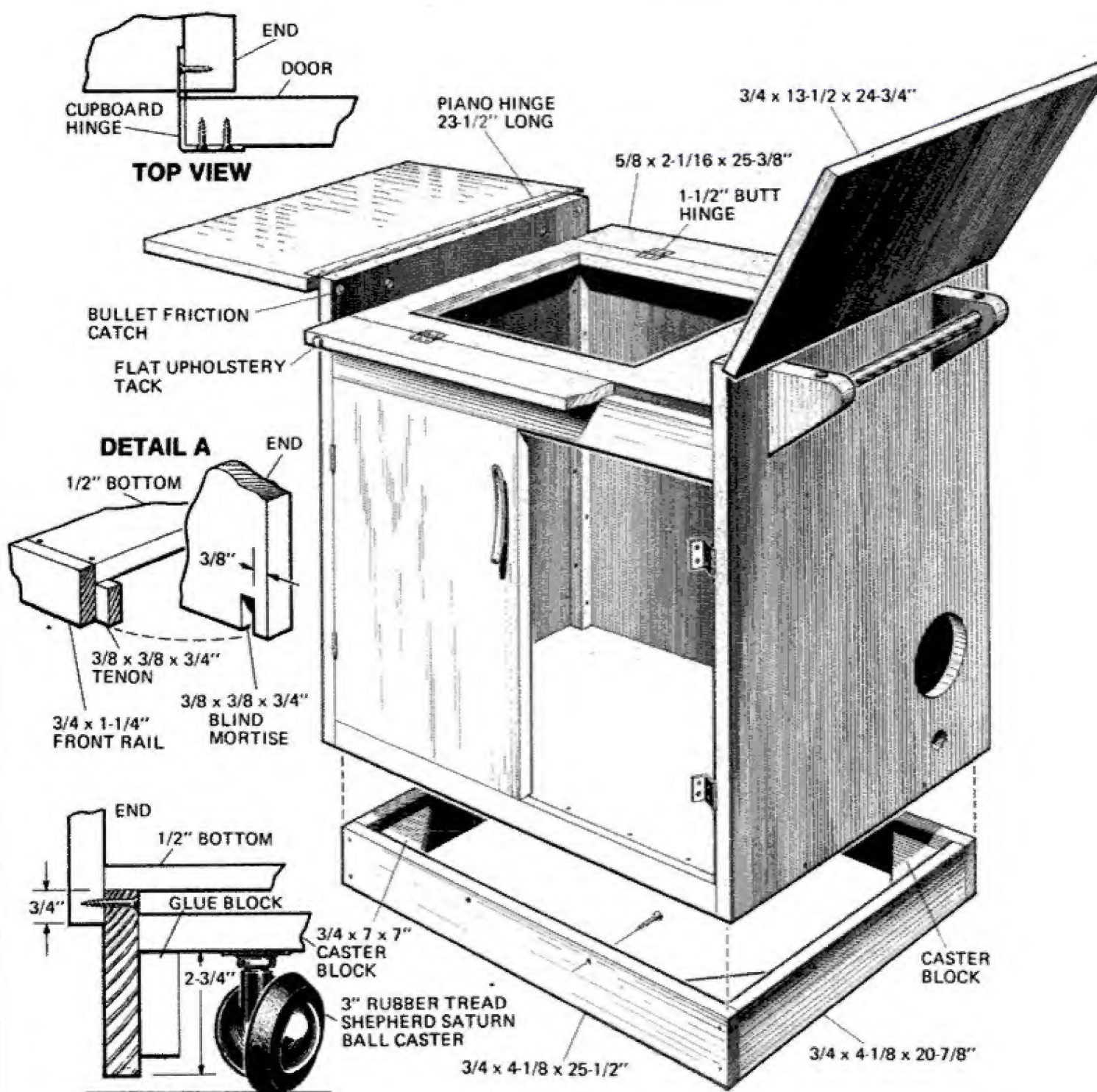
When the grill is not in use, snug-fitting caps plug the exhaust ports in both the wall and cabinet. The duct and cable store inside and the cabinet top folds shut to hide the grill.

The boxlike design of the handsome Danish-modern cabinet helps simplify construction. It's made entirely of oak-veneer plywood, (stained dark brown) except for the black-painted base and the bottom shelf. Butt joints are used for the most part and reinforced on the inside with square blocks glued in the corners. Both ends are the same size, but right and

left-hand, with a 5-in.-dia. hole being cut in the right-hand one. Both are blind-grooved on the inside at the front for the bottom crossrail. The back butts between the ends, as do the grill cutout, the 3 $\frac{3}{8}$ -in. crossrail and the bottom. The storage section of the cabinet is fitted with twin doors and equipped with suitable pulls and magnetic catches.

The two-piece top is joined with piano hinges and supported when open by handles on the ends of the cabinet. Flip-down aprons hinged to the grill cutout, front and back, support the top when closed;

(Please turn to page 172)



A little colonial charmer you can build for \$45

By WAYNE C. LECKEY, Home and Shop Editor

Photos by Robert D. Borst/Cabinetry by Everett Johnson



SERVING ORIGINALLY as a place to wash and to store a porcelain water pitcher and bowl, the charming colonial dry sink of yesteryear continues to be a graceful and useful piece of furniture some hundred years later.

Today it provides a perfect place to display your indoor plants; it has two roomy drawers felt-lined for silverware and there is ample storage below for linens behind two raised-panel doors.

We built the little beauty you see here for about \$45 from common pine which you can buy at any lumberyard. Its authentic design makes it a collector's item, and its simple construction makes it a natural for the home craftsman to duplicate.

The ends require pieces which measure 17½ in. wide. Since you can't buy pine this wide, you will have to glue and dowel several 1x8 (¾ x 7½ in.) boards together. With the possible exception of the doors, the ends are the only members you will have to build up. The wide pieces for the sink top, shelf, bottom and back are cut from plywood. Both ends are worked as right and left-hand members when you run the dadoes across the inside, cut the rabbets for the plywood back and rip the set-back edges at the front. The latter is done on your table saw to assure a straight cut. Here the work is ripped ¾ in. in from the edge for a distance of 26½ in., then

backed off and the stopped cut is finished by hand. Notice that the ¼-in.-wide rabbets along the rear edges are made ¾ in. wide for a distance of 7 in. down from the top.

The scroll design at the top of the ends is cut with your sabre saw, then both inside and outside edges are antiqued (distressed) by rounding and sanding.

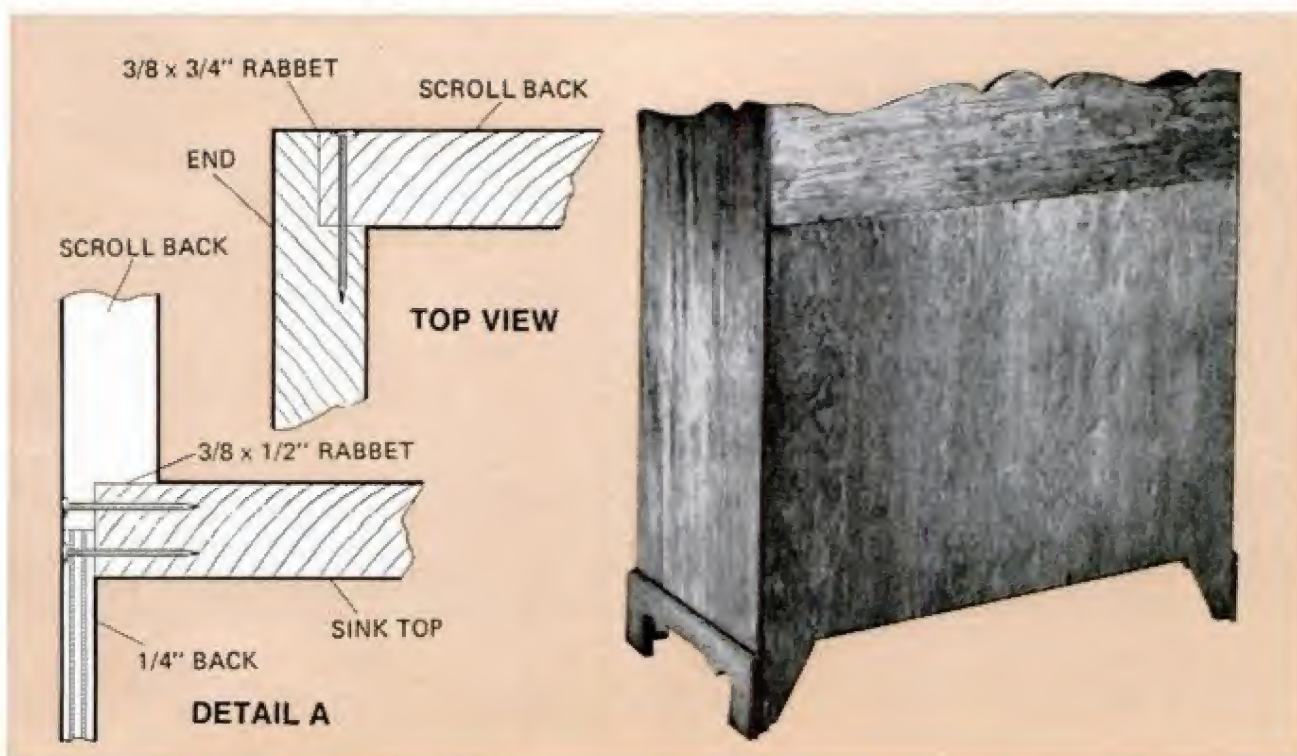
When you have the sink top and bottom plywood members cut to size, you can glue them in the dadoes of the solid-pine ends. Use long clamps if you have them and check the assembly with a square before setting it aside.

While the glue is drying, make the scroll-cut member for the back. This is cut from a 1x10 pine board to rest in the ¾-in. end rabbets previously made and has a rabbet cut along the bottom edge to fit over the sink top. Round and sand the edges of the scroll as you did the ends and then glue and nail the piece in place, driving the nails from the back.

Next, make the framework for the front. This is a separate unit made from ¾-in.-pine strips to fit flush with the ends of the cabinet and even with the top surfaces of the sink top and bottom. Butt, dowel and glue the joints; if you have clamps, use them to pull the joints together. When the framework is completed, glue it to the cabinet.

Now you can add the scroll-cut base to

REAR VIEW shows how back panel is cut to provide "legs" that support corner glue blocks on the inside



A 1/4-in. back is added to the cabinet next. Notice that it has "legs" at each side

Now you can make the slanting front piece. It is rabbeted along three edges to lap the front frame and the cabinet ends, and

3/4 x 1-3/4" STILE

1-1/16"

3/4"

1-3/4"

END DRAWER RAIL

1-7/8"

3/4"

3-3/8"

CENTER DRAWER RAIL
DETAIL B

1/4 x 3/4" DADO

BOTTOM

END

1/2"

3/8"

45° BEVEL

BASE SECTION



MITERED
CORNER

BETTER WAYS TO DO IT!



CONVEX AND CONCAVE PROFILES are easy to sand if you cement sandpaper to both sides of a piece of garden hose slit in half lengthwise. The flexible hose adapts readily to curves.—*Frank Shore, New York*



BEFORE PANELING over plaster, run paint stripes down the wall where the $\frac{1}{4}$ -in. panels will butt, so wall won't show should panels shrink. Color should match panels.—*Mitchell Feldman, New Hyde Park, N.Y.*



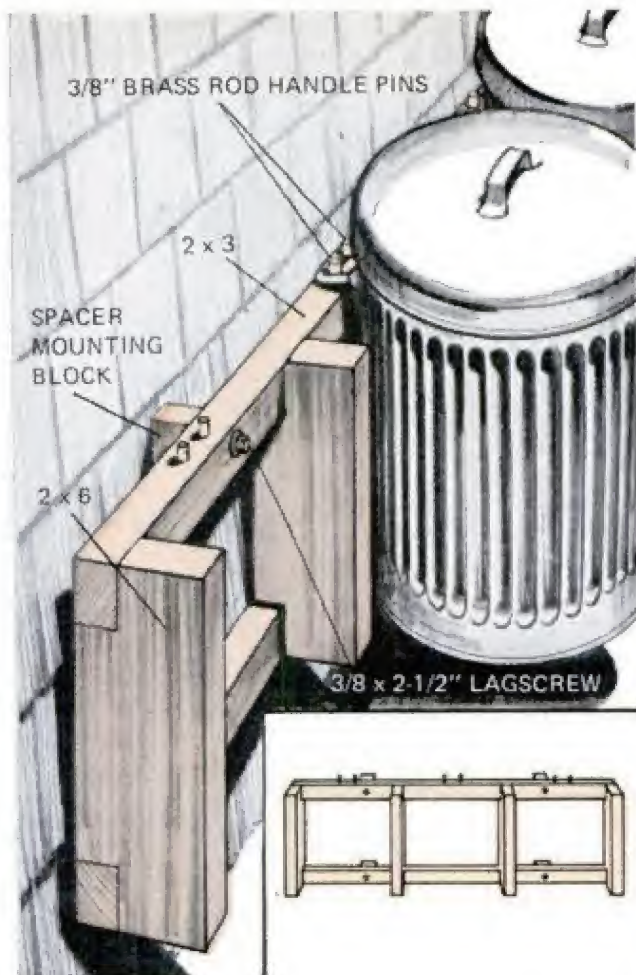
FOLDED TROUSERS will stay on wooden hangers if you try this trick. Simply rub on a coat of silicone cement or liquid rubber. After the liquid dries, you'll have a nonslip surface.—*R.S. Tupper, Canton, S.D.*

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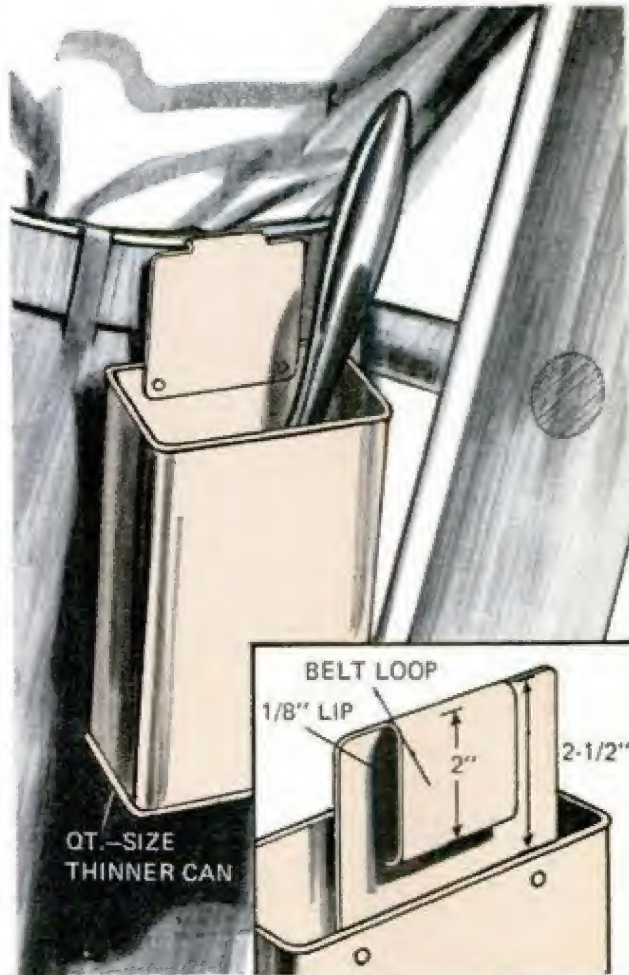


KEEP YOUR EYEGLASSES SLIP-PROOF by adding a strip of adhesive-backed foam material to the bows. Since you need little material, the strips can be renewed as necessary.—*Harry Radzinsky, Charlotte N.C.*

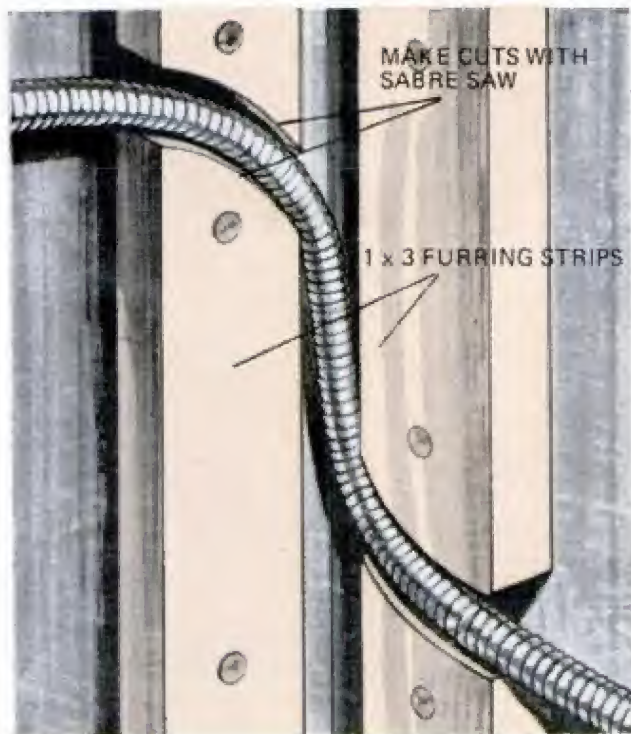
POPULAR MECHANICS



TRASH-CAN RACK, if built as shown and installed on the side of a garage, will eliminate the messy problem of your trash and garbage being upset by animals or the wind.—W.J. Therrien, Amesbury, Mass.



HANDY PAINTBRUSH HOLDER can be made from a used quart thinner can for use when you work on a ladder. Cover any sharp edges with electrician's tape to prevent cuts.—Al H. Nefzger, Elk Mound, Wis.



TO INSTALL BX CABLE at inside corners on the face of a furred wall, notch the furring as shown; then cover the cable with safety (metal) plates nailed to the furring.—Wallace H. McClay, Pasadena, Calif.

FEBRUARY 1972



WHEN ROOFS BLEW OFF a few neighbors' patios, I decided to make mine more secure by pouring post-anchoring footings as shown. The trick has worked and our roof is intact.—George Oxford, Boise, Idaho

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This radio-controlled model flies on CO₂

The fuel is nonflammable and odorless, and the model emits no more than a buzz in flight.



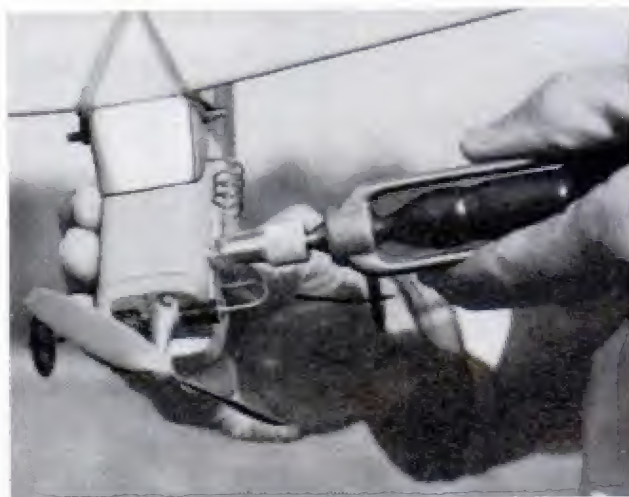
By **HOWARD G. McENTEE**

Technical Art by Fred L. Wolff

WHETHER YOU CONSIDER yourself a typical, experienced model-builder, or are an "ace" at local model plane meets, you might like to add this little engine-driven plane to your squadron.

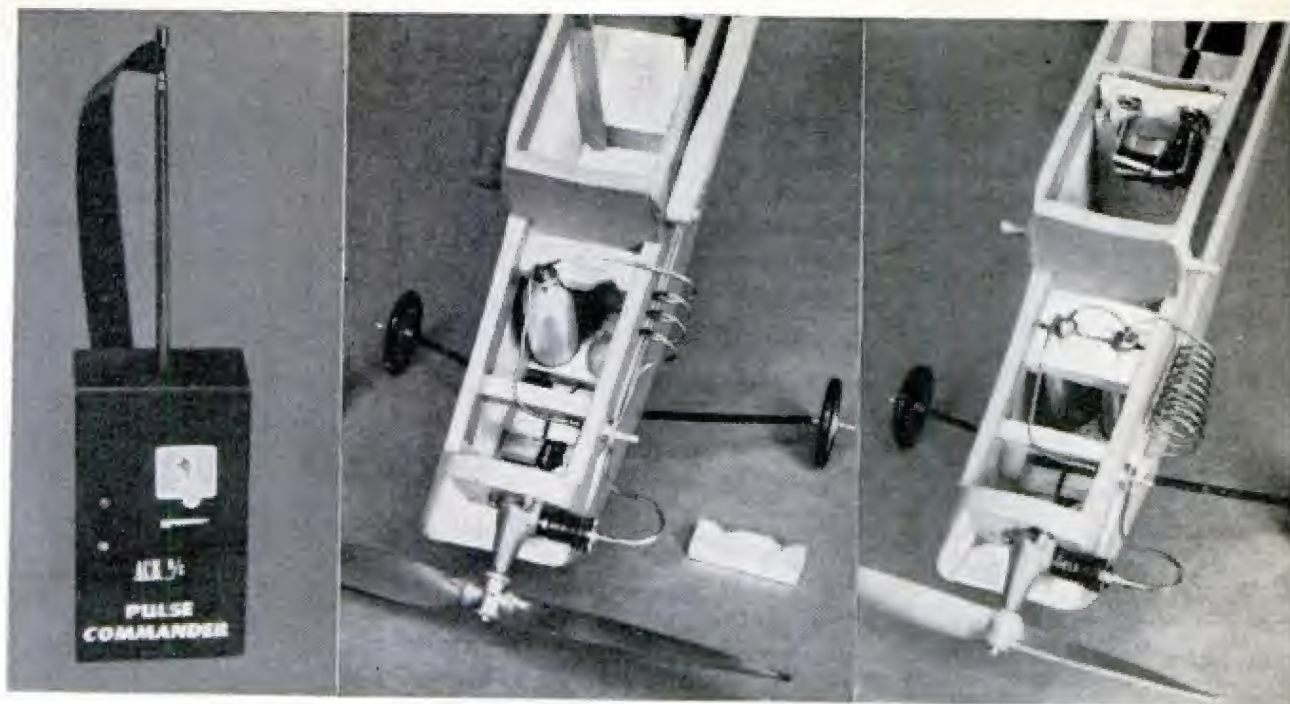
- *You can fly it just about anywhere.* Its powerplant is scarcely louder than a bee.
- *Fueling is a simple, odorless operation.* There is no smoke problem.
- *It's sophisticated but fairly simple to build.* (For a still easier job, you can get full-size patterns; see page 148.)

Carbon dioxide gas (CO₂) is the fuel. Under pressure—as it is in the containers

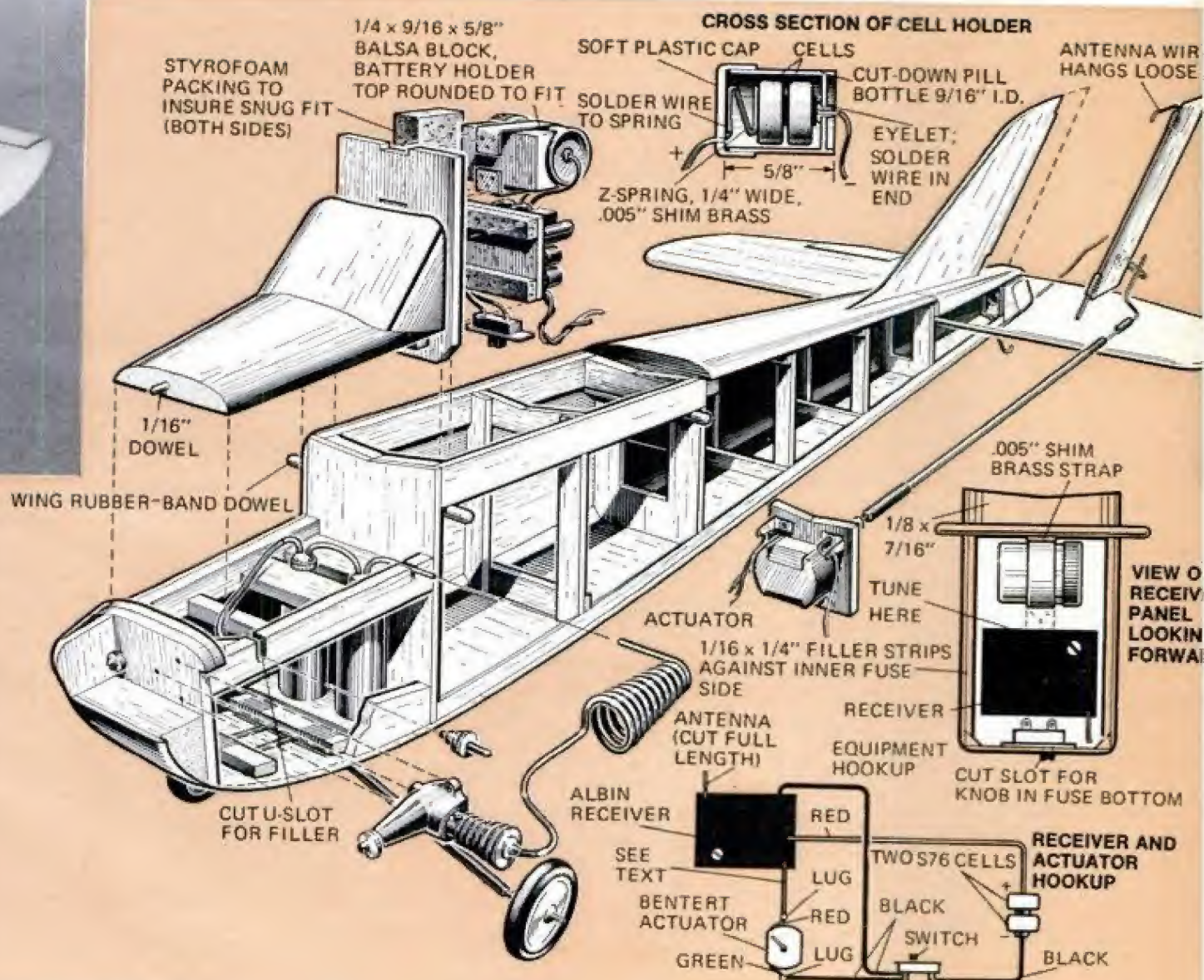


TO FUEL THE TANKS, press cartridge holder against filler tube. Valves open automatically to let fuel in

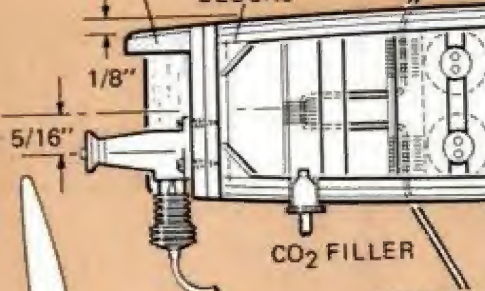
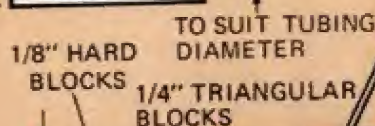
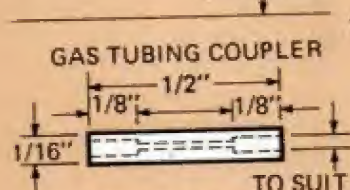
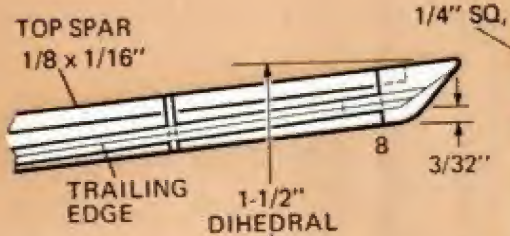
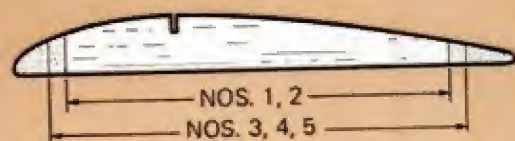
POPULAR MECHANICS



TRANSMITTER (left) used in this model is part of a control system that's too large for this plane; thus, stick works backward here. In free-flight version (center) only one tank is used. Provisions are made for installing two tanks for a complete, radio-controlled version (right)



SCALE: 1/2" EQUALS 1"



SOFT BALSA, PARTIALLY HOLLOWED

1/8" PLYWOOD

DOWEL PIN

1/4" HARD TRIANGULAR BRACES

1/8 x 1/4" HARD

RADIO "SPAGHETTI"

1/16 x 7/16" HARD BALSA STRIP

CO2 TANK

1/16" HARD, CROSS GRAIN

SOFT BLOCK

7

1/16 x 1/8" HARD BALSA

6

TOP SPAR

SPLICE

5

TRAILING EDGE

4

ALL RIBS 1/16" THICK EXCEPT NO. 2 WHICH IS 1/8" THICK

3

1/8" HARD BALSA JOINERS

1/16 x 1/4" 2

1

ACTUATOR

1/16 x 7/16"

CENTER OF GRAVITY

1/4" SQ., SOFT

RIB NO. 1

2 PLY ACTUATOR MOUNTING-BOARD

C

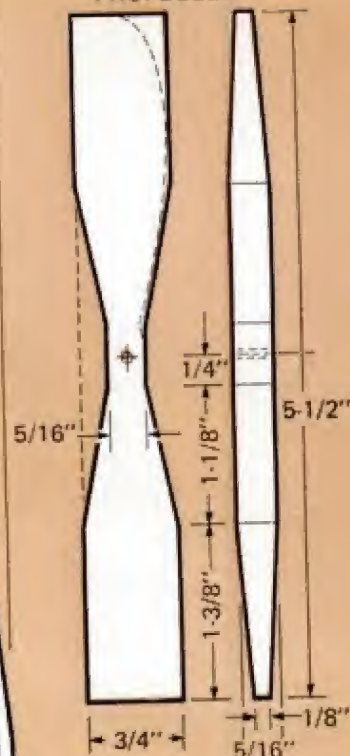
D

E

CLAMP PLIERS ON ACTUATOR SHAFT WHEN SOLDERING

POPULAR MECHANICS

PROPELLER



TRIM TO BLADE SHAPE AFTER CARVING

.045" MUSIC WIRE

1/8" DOWEL

1/16" SOFT DOUBLER

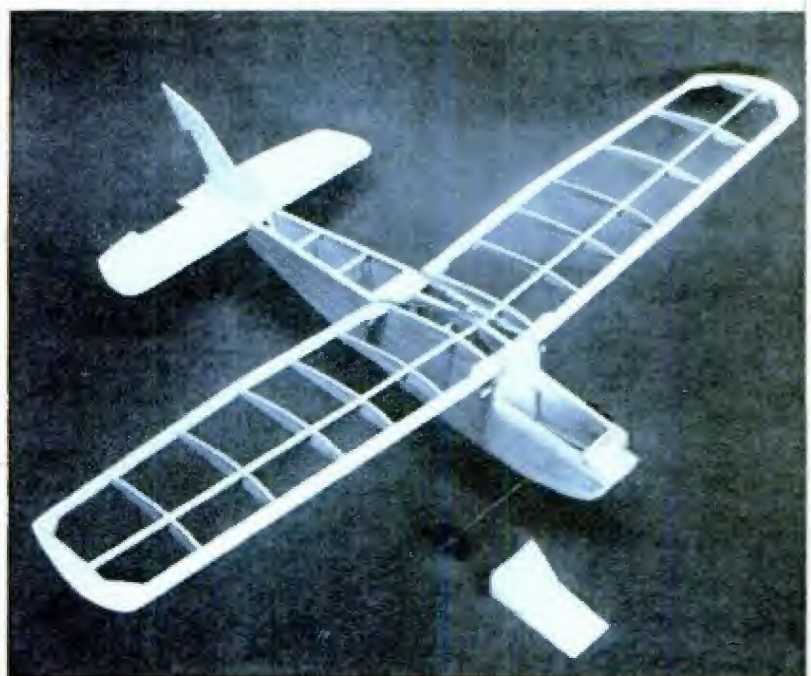
1/32" SIDE, SOFT SHEETING

1/32" SOFT, TOP AND BOTTOM

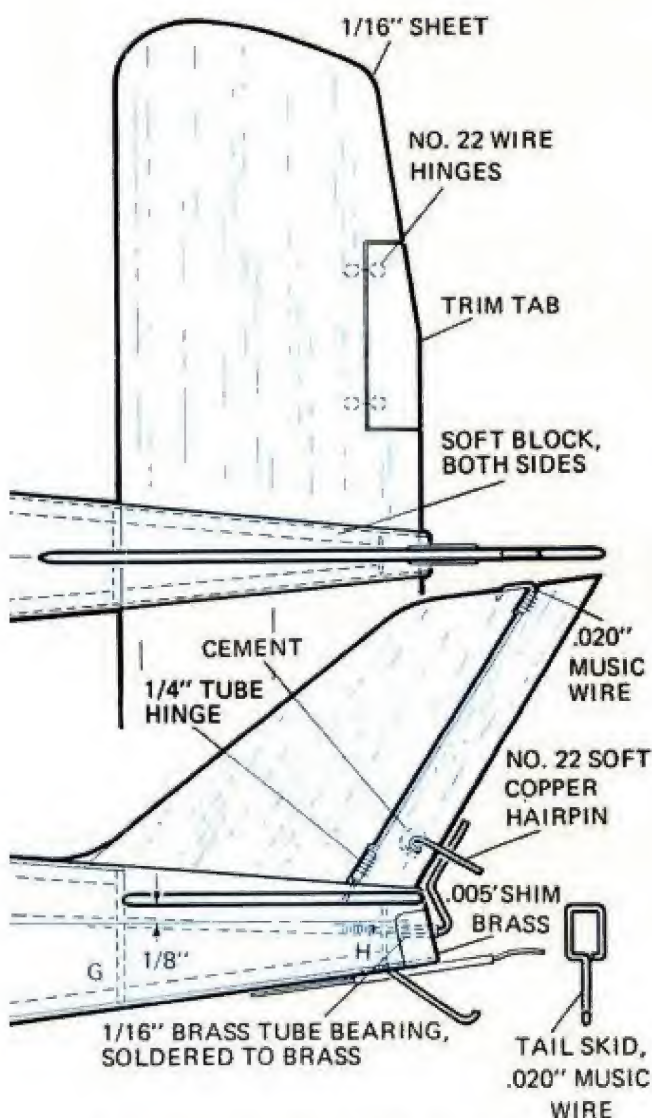
SOLDER



RUDDER LINKAGE holds the rudder full-left with receiver off. Antenna end simply hangs free



READY FOR FINISHING, hatch cover and "windshield" are near the wheel. The trim tabs are not yet attached



BIND WIRE TO DOWEL AND CEMENT

you buy—the gas is a liquid, which means enough can be carried in a small tank for long flights. (The liquid vaporizes as it expands to drive the engine.)

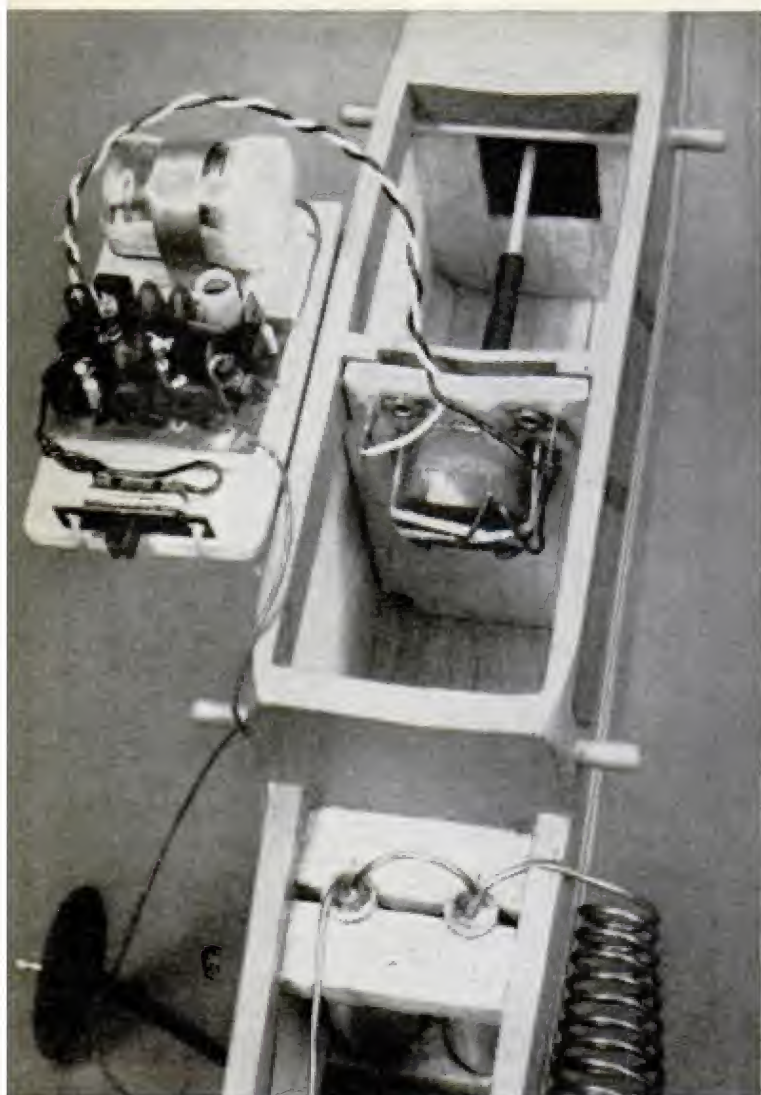
The powerplant is similar to a steam-propulsion unit in that the tiny CO₂ tank in the plane acts as a "boiler" and the surrounding air as the "fire." Under high pressure in the tank, the liquid CO₂ travels through an exposed coil in which it is warmed to outside temperature. When it reaches the engine, it is a high-pressure gas. A tiny ball valve in the cylinder head, opened when the piston reaches the top of its stroke, meters the gas into the cylinder as needed.

This little plane, which we've named the *PM-Bee*, can be built as a free-flight model or as a radio-controlled flier. Very lightweight commercial equipment is now available to make R/C flying of such tiny planes quite practical.

While of simple construction, the *Bee* is not a first project for beginners; its delicate balance acquires some skill to achieve. But for the powerplant, cost of materials is low.

Keeping weight down is a must to obtain best flying qualities. Pick all wood carefully. Use a minimum of cement (just enough for firm joints) and as little dope on the completed plane as necessary.

The fuselage sides and doublers (the latter run forward from station E to the nose) are of soft $\frac{1}{16}$ -in. sheet; the heavier outline on the fuselage side view shows exact shape to cut the sides. The doublers are the same, but taper off between stations



RADIO-COMPONENT BOARD is taped along fuselage; note actuator on mount, torque rod, tubing coupler

D and E. The two are fastened together with a light coat of spray contact cement; apply to both pieces, let dry for five minutes, then carefully fit and press together.

The upper firewall is backed up with another piece of the same plywood to hold tiny screws that fasten the engine in place. The engine may then be shimmed with small washers under one or two screws to the exact angle required for best flight. The nose compartment is braced with $\frac{1}{16}$ -in. strips on upper edges, and $\frac{1}{8}$ -in. at the bottom.

Bottom strips first must be notched to hold the landing gear cross strips. Triangular strips cut from $\frac{1}{4}$ -in.-sq. hard balsa further bind the firewall to the fuselage sides. Complete the nose area with a scrap of $\frac{1}{8}$ -in. sheet vertically inside the right-hand sheeting, and fit the hard lower block.

Bend the main landing gear as shown in the flat view, bind it to a hardwood (spruce or hard balsa) crosspiece and



LEFT TO RIGHT: powerplant, tank filler tube, CO₂ cartridge (sold locally) and a cartridge holder

cement into place. Install the forward crosspiece and bind the wire tongue to it.

The hatch cover is cut from soft balsa, trimmed to match fuselage sides and fitted with a dowel pin at the front end. The "windshield" is also soft balsa with grain as indicated; the lead edge of the wing clamps the entire hatch assembly in place.

For free-flight operation, one gas tank will serve well, but if you will add radio control, provide *now* for two tanks. The powerplant, small propeller and cartridge holder are available from Brown Junior Motors, Inc., Box 44, Pine Grove Mills, Pa. 16868. CO₂ cartridges may be purchased at department stores.

A radio-controlled plane requires a second tank because the radio adds about an ounce to total weight (the plane shown weighs 3.3 oz. ready to fly). An RC model must be operated "wide open" to keep it aloft and fuel is used at a faster rate.

Additional parts needed for conversion to radio control are a Pulse Commander rudder-only transmitter, one Eveready 276 9-v. battery, one Ace Albin receiver kit, two Eveready S76 silver oxide cells, one Bentert small actuator and one Switchcraft sub-mini SPST slide switch. These parts are available from Ace Radio Control, Box 301, Higginsville, Mo. 64037. You can get a nylon propeller for the Brown CO₂ engine from W. C. Hannan Graphics, Box A, Escondido, Calif. 92025. ★★★

FULL-SIZE PATTERN AVAILABLE

To obtain a full-scale pattern from which you can trace off the parts directly, send \$3.49 to Popular Mechanics, Dept. PM-Bee, 224 West 57th St., New York, N.Y. 10019. Price includes postage and handling. Allow two to three weeks for delivery.

POPULAR MECHANICS

HINTS FROM READERS

Improved 'depth gauge'

A simple gauge for checking the depth of a bored hole can be made by slipping a pencil pocket-clip over the shank of a Phillips-type screwdriver. As the driver is pushed into the hole the ball end of the clip against the hole rim forces the clip to slide. After removing tool, simply measure distance between the tip and the ball end.

—W. B. May, Oak Park, Ill.



Substitute for masking tape

Next time you run out of masking tape while painting, try using scraps of self-adhering shelf lining. After cutting it into strips, position the material where it's wanted and use a sheet of newspaper under a portion of it away from the edge to be painted. The paper trick makes removing the liner a snap after paint has dried.

B. W. Ervin, Kent, Ohio



Increasing pry-bar range

I've found that by providing an adjustable, sliding collar on my pry bar, the distance through which it can effectively operate is increased considerably. The bar shown is of 1/2-in.-steel rod and the 3/8 x 1 3/4-in. collar was salvaged from my scrap box. The collar was drilled and fitted with two 1/4-in. setscrews to lock it in place.

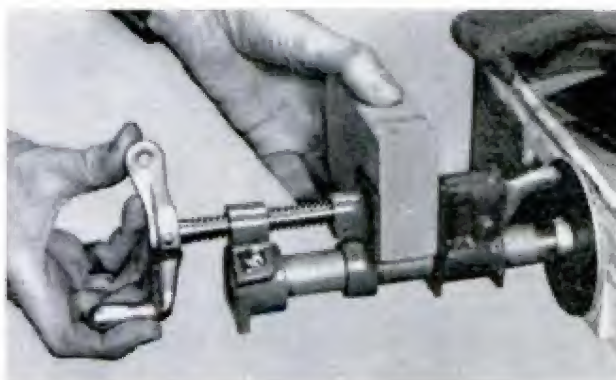
—Walter E. Burton, Akron, Ohio



Pipe clamp serves as a vise

By attaching several 3/4-in. pipe flanges to my workbench at various locations, I can now use my 3/4-in. pipe bar clamps (and assortment of pipe lengths) as a sort of "portable" vise. The flange provides a strong, stable base for the clamp; when the extra vise is not needed, I simply unscrew the clamp and hang it on the wall.

—Paul R. Roman, Maple Heights, Ohio



Notched nut cleans threads

If a half-dozen or so notches are spaced at intervals across the threads of a nut, the nut may be easier to screw on a bolt having clogged threads. The notched nut removes rust and dirt by scraping action (much like a die chip trap), and once the bolt threads are clean, the nut can be replaced by an unmodified nut.

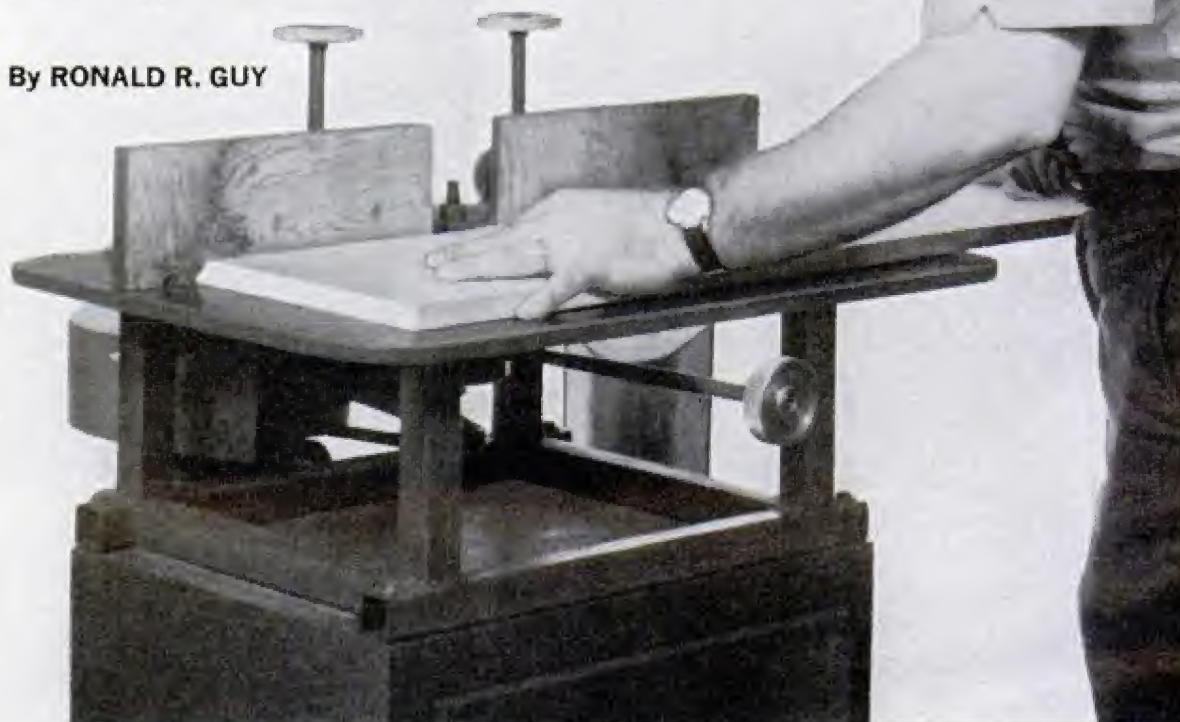
—Walter E. Burton, Akron, Ohio



Make this shaper for \$60

Starting with a used motor, the author built this handy tool for making his own moldings.

By RONALD R. GUY



Photos by the author and Rose Marie Guy

TO THE SHOP CRAFTSMAN who takes his woodworking seriously, a shaper is a necessary machine—not just a luxury. Substitute measures, such as putting a molding-head cutter on a table saw or speeding up a drill press and using it as a shaper, are adequate for occasional use, but as your woodworking output increases, the urge to have a shaper at-the-ready will justify owning one.

If you have a couple of hundred dollars burning a hole in your pocket the solution is easy: Simply buy one. But, if you would prefer investing time—instead of money—this shaper is the answer. If you don't own a metal-turning lathe, the few turned parts required can be farmed out to a lo-

cal machine shop. You may even know of a fellow craftsman who has a lathe.

Begin construction by making the spindle housing from a 3¼-in.-dia. bar of mild steel. Turn this to a 3.121-in.-dia. using a round-nose finishing tool and a fine feed to obtain a very smooth finish. Now place this in a four-jaw chuck and, using a dial indicator, adjust the chuck until the part runs dead true. Bore the first bearing seat, being careful to get a smooth press fit with the bearing, then reverse the piece in the chuck. Again adjust until it runs *dead true* (this is very important) and bore the second bearing seat, again getting a smooth press fit. Follow this by boring a hole all the way through (see plans) and

you will have completed all the difficult work to be done on the spindle housing.

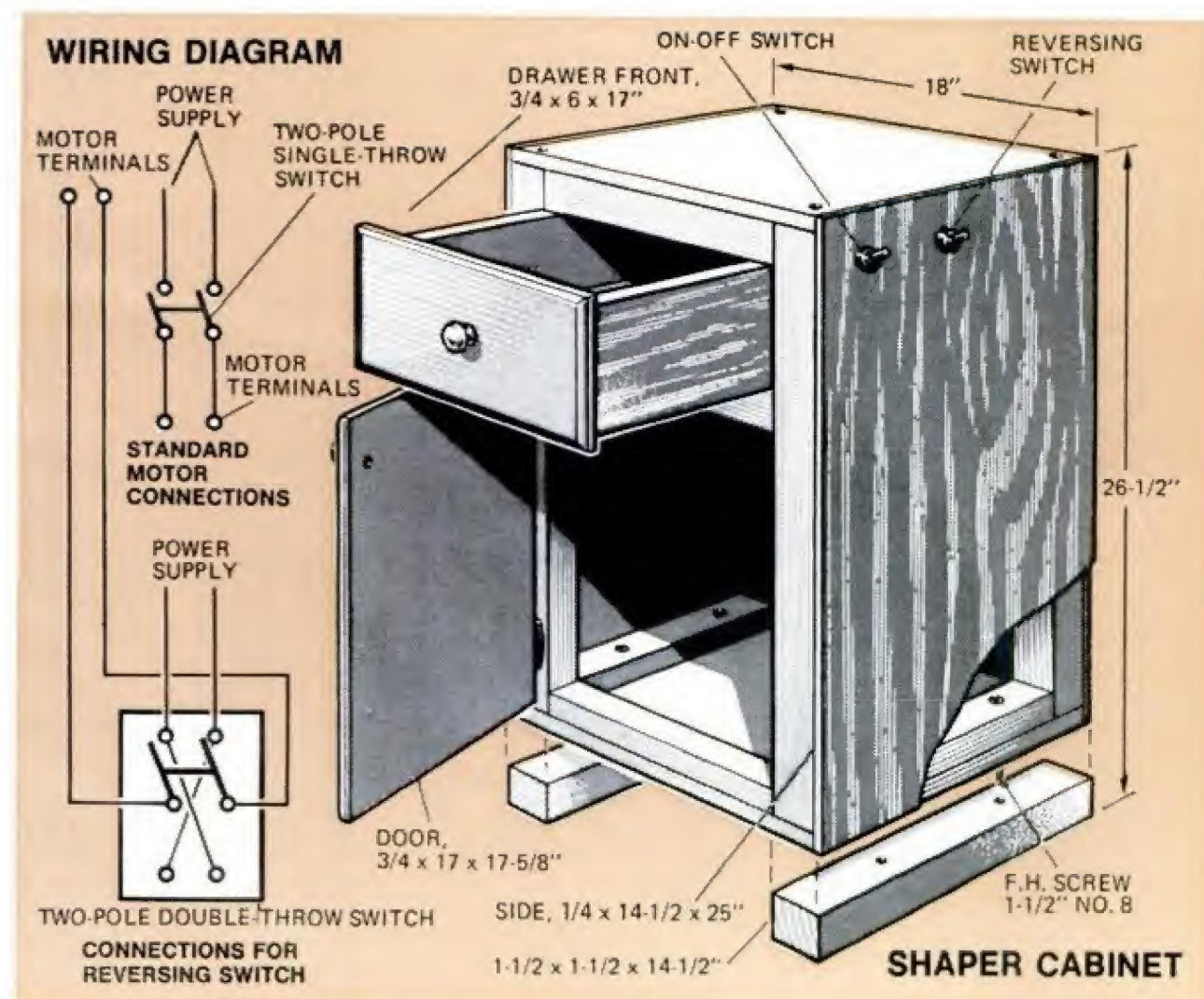
Tackle the spindle next. This is a simple job, and for maximum accuracy should be done between centers or with collets. It is important that you get a smooth press fit into the bearing races so take the time to get a good, smooth finish on the part that fits the bearings. File or mill a flat on the section where the pulley fits and also put four flats around the top of the spindle so it can be held with a wrench when you're changing cutters. It is advisable to case-harden the flats where the wrench goes; also the $\frac{1}{2}$ -13 nut that holds the cutter on the spindle (to avoid burring).

Now you can proceed to the housing height-adjustment tube that controls the vertical adjustment of the cutter. It is made from a piece of heavy-wall-steel tubing and a 5-in.-dia. disc of $\frac{1}{4}$ -in. steel. After boring it out to 3.125 in. it should have a smooth sliding fit with the spindle housing. Finish up by cutting the angled slot with a $\frac{1}{2}$ -in. end mill.

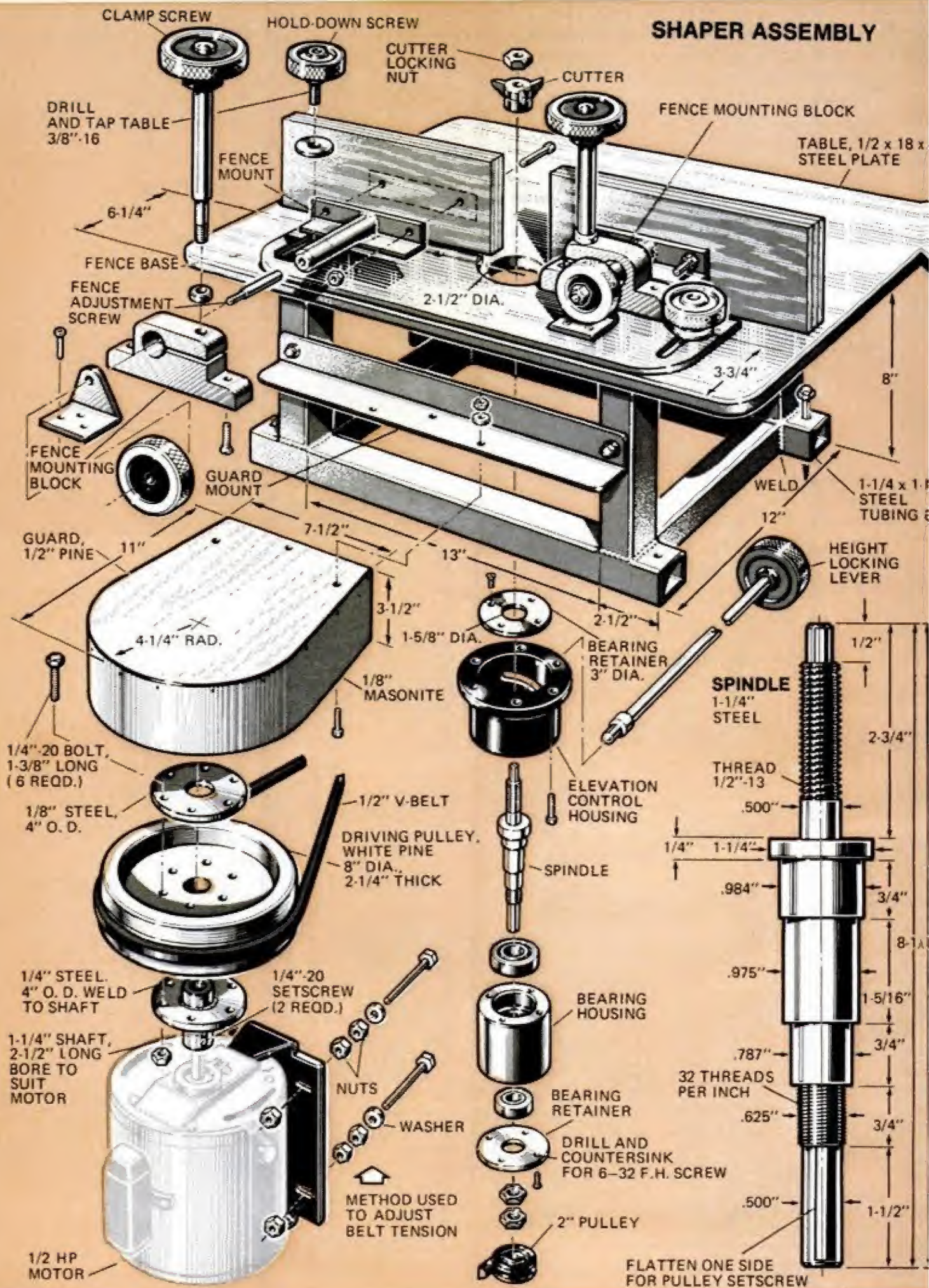
Next, make the knob and shaft used to



CABINET BENEATH SHAPER is of a simple, boxlike construction. Drawer can be partitioned for cutters

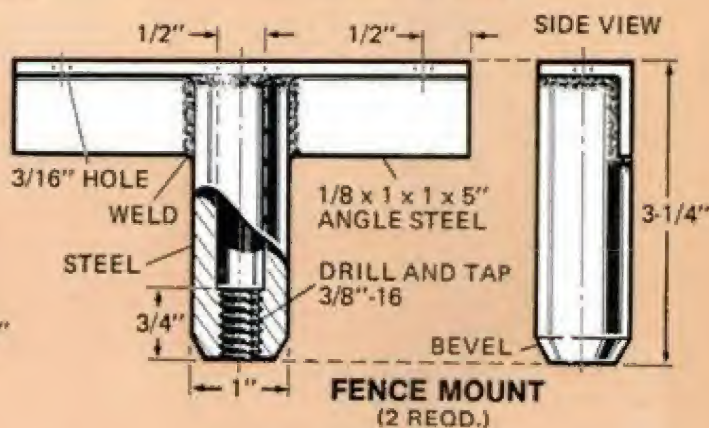
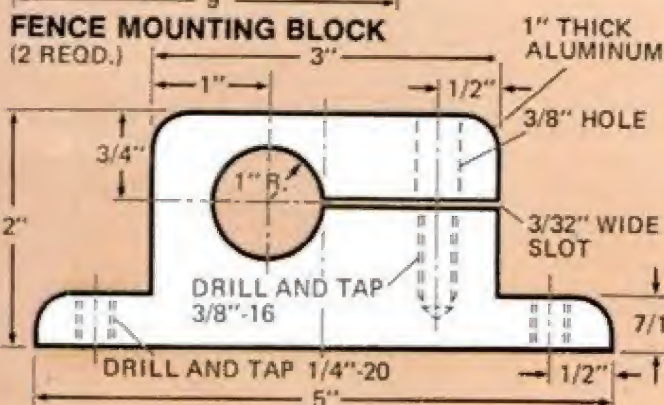
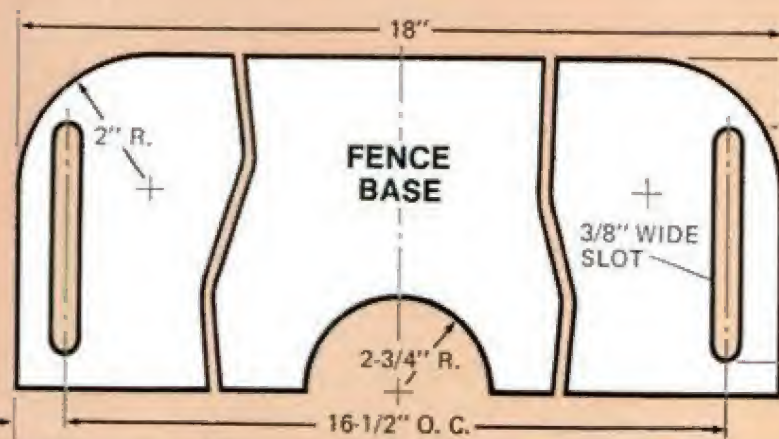
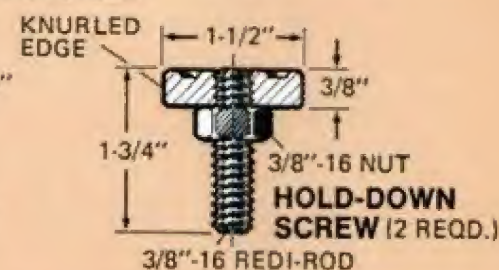
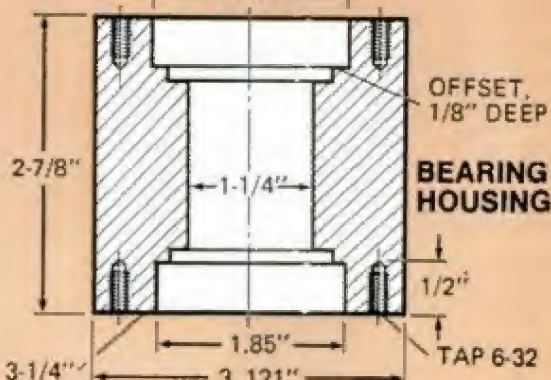
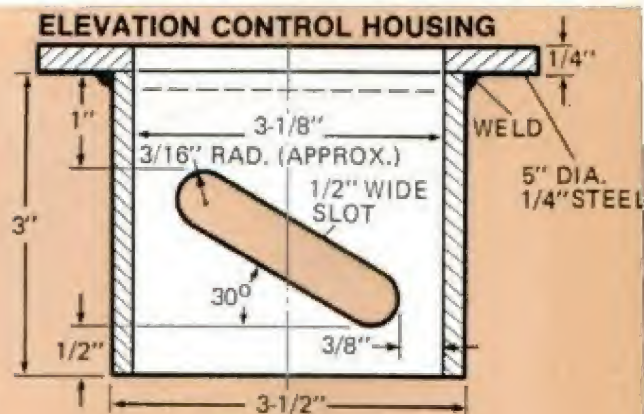


SHAPER ASSEMBLY





ALL SHAPER PARTS were machined in the author's shop using dimensions shown in drawings. Fence, of course, is adjustable



adjust and lock the spindle housing in the tube. Then machine the discs used to hold the bearings in the spindle housing. At this stage, you've finished the most difficult part of the shaper construction and you can start on the table, frame, fence, base and the like. Ask your steel supplier to cut a piece of 1/2-in. steel plate to 18 x 24 in. Round the corners and cut the hole for the spindle. A sabre saw will do all this nicely, and beeswax makes a fine lubricant. Finish the hole smooth with a

small drum sander or grinding wheel chucked in an electric drill. Use a disc sander for the corners.

Now you can lay out, drill and tap the holes for mounting the fence on the table. Then turn the table over and position the spindle assembly over the hole (a wood disc on the spindle that fits the hole is a great help), making sure the slot faces the front of the table. Drill and tap the holes for bolting the vertical adjustment tube to the bottom of the table. Bolt it down tight,



Today, a man needs a good reason to walk a mile.

Start walking.

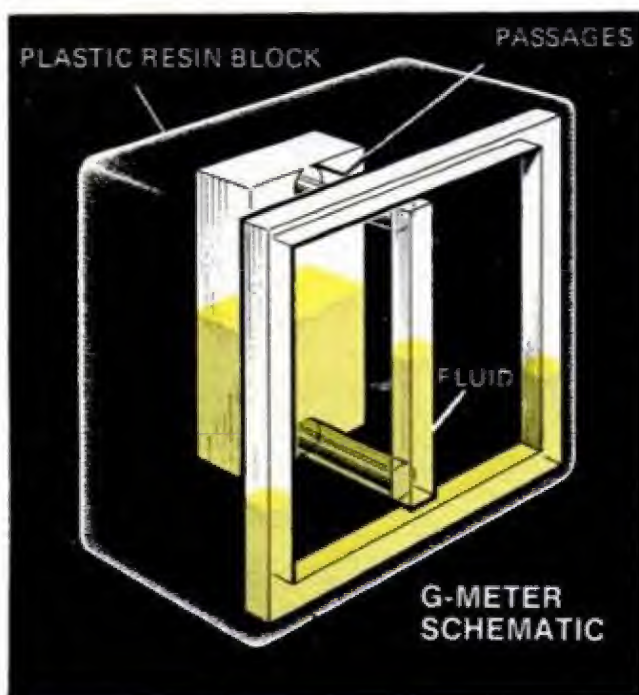


25 mg. "tar," 1.5 mg. nicotine
av. per cigarette, FTC Report AUG. '71.

A 'G-meter' you can add to your dashboard



With an accelerometer you'll measure pickup, detect flat points in acceleration and know when your car needs tuning



YOUR CAR is constantly being tugged by the forces of acceleration. Each time you step on the gas, hit the brakes or make a turn, your auto is either shoved forward, dragged back, or yanked from side to side. These forces can be measured by an accelerometer similar to those the astronauts use for navigation. Race-car mechanics now have begun to use accelerometers in the final tune-up of their machines.

You can build your own accelerometer, which I've called the "G-meter," by casting clear resin in a simple mold. The resulting block of plastic encloses two sets of fluid-filled passages which measure ac-

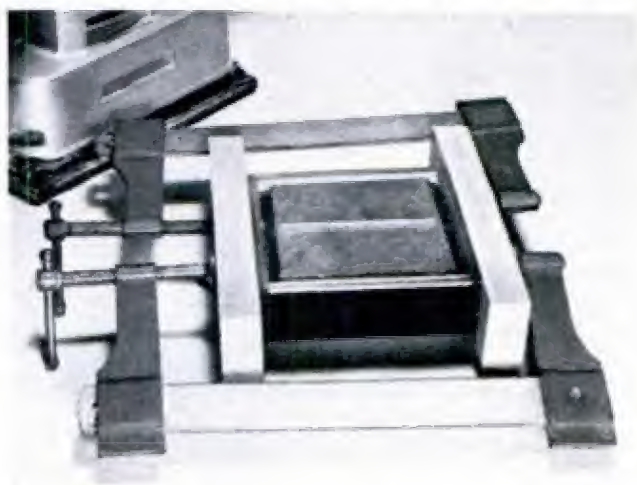
SCHEMATIC shows channels which contain an ethylene glycol antifreeze (without stop-leak additive)



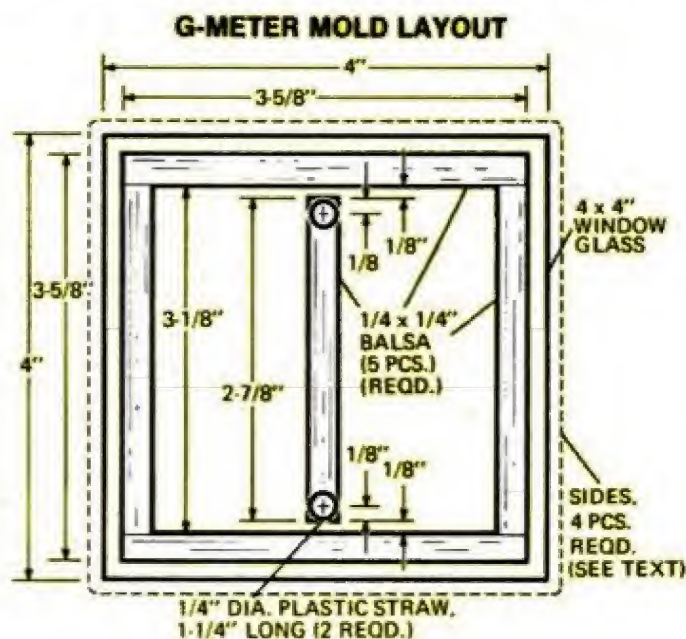
COMPLETED MOLD, with balsa and soda straws in position, is ready for the first pour of clear resin



AFTER PLASTIC BOX is placed over ends of straws, the last pour of the casting resin can be made



HARDWOOD BLOCKS clamped to each side of meter body (above) insure that the sander will leave a flat surface. Drawing at right gives all dimensions for making the G-meter mold for casting operation



celeration forces along two axes: longitudinal (forward-reverse) and lateral.

The force scales are calibrated in Gs, making them universal. A force of 0.25 G, for example, will accelerate a roller skate, car or locomotive from zero to 60 mph in 11 seconds.

To find out what the accelerating force will be in pounds, multiply the G reading by the vehicle weight. In the top photo on the facing page, the meter reads 0.3 G acceleration and 0.1 G pull to the left as the car merges from the right and picks up speed.

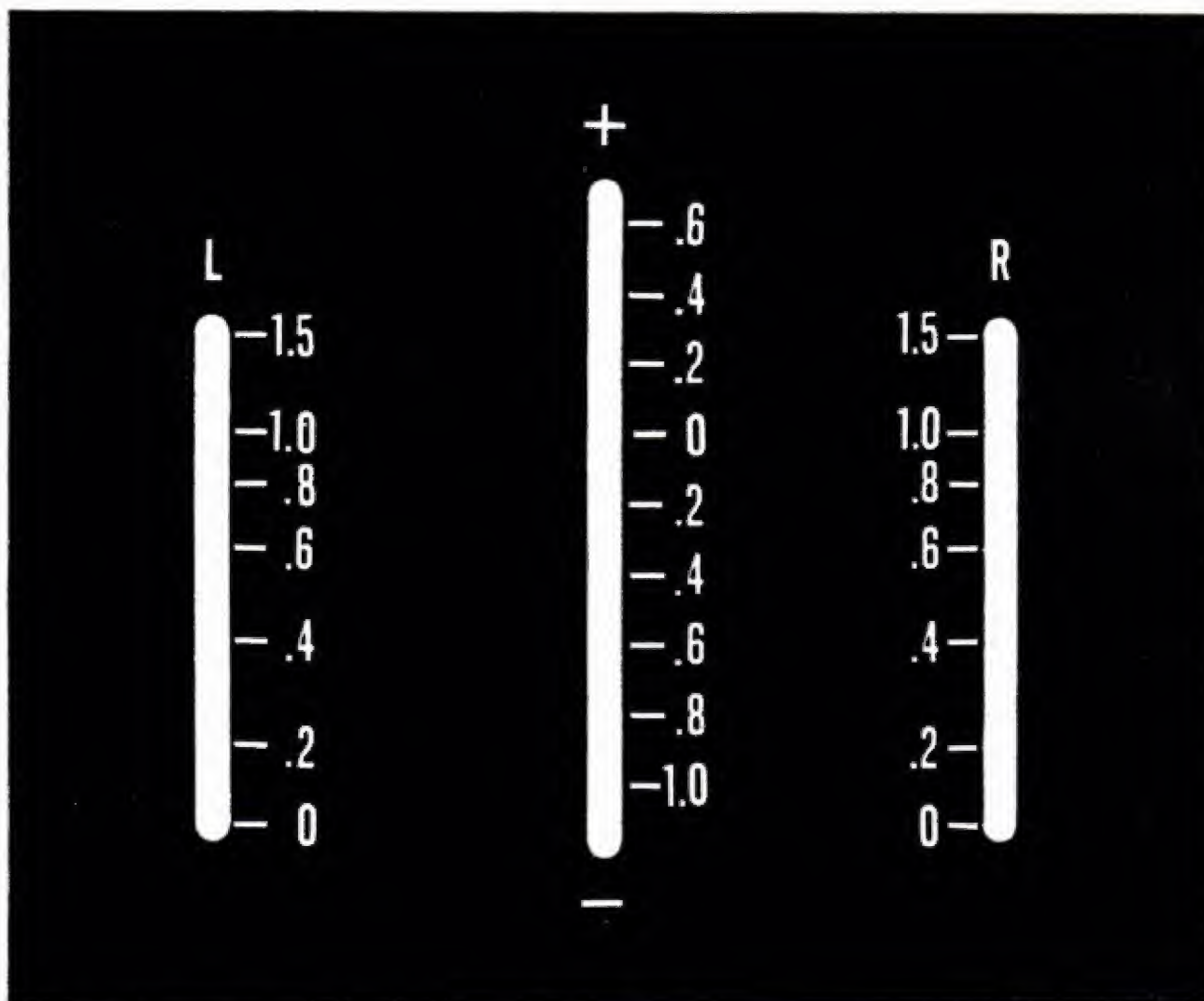
The longitudinal system gives you an instant check on your car's performance under operating conditions. It detects flat points in acceleration, evaluates changes made to engine or power train and helps

select shift points. It can tell you when a tune-up is needed and whether the tune-up was done right.

You can also check your brakes with this system. (Braking results in negative longitudinal G readings.)

You don't need a level road to use the G-meter. On hills (up to 15 percent slope) the meter still reads the total go-power being put out by the car. Only the measured time to reach a certain speed will be affected. But strong winds will disturb the readings.

The lateral system of the G-meter is more interesting than functional. As your car rounds a turn, the meter will read the centrifugal force being resisted by your tires. The readings will be reduced by a properly banked turn. There is one speed



SCALES SHOWN ABOVE are actual size, can be cut out and pasted on the meter or, better yet, copied on film by a litho service shop. The latter method will give you back-lighted, easy-to-read lettering

on banked turns where the reading will be zero.

A skilled race driver on a good track could use the G-meter to evaluate his car's cornering ability. The average driver in a standard car on a public road could come to an untidy end trying the same thing. But you can use the G-meter lateral reading as an indicator of passenger comfort on turns.

Clear casting resin is molded to make the meter. We used materials sold by American Handicraft Co., 1011 Foch St., Fort Worth, Tex. 76107. You need only minimum quantities: one quart of "Clear Cast," a pint of "Surface Coating Resin," an ounce of catalyst and a half-ounce of red transparent dye.

The liquid resin pours just like corn syrup and will set in a few hours when catalyzed, after which it can be sanded and machined.

Follow the health and safety instructions on the label. The various materials

are flammable, toxic, caustic and potent smelling. All measurements given are for Clear Cast; if you use another product, adjustments may be called for.

First make a mold. On a 4-in. sheet of window glass, position five strips of ¼-in. balsawood as shown in the mold layout and tack them down with dabs of rubber cement. Cut four pieces of plastic laminate 2¼ x 4 in. for the mold sides. Use freezer tape and the laminate (finished surface inward) to make an open-topped box with the glass as the bottom. Warm the box, melt paraffin in a double boiler, and then coat the entire inside of the box with the paraffin.

Next, cut the two lengths of plastic drinking straw and stuff them with tissue. Dip the straws in paraffin, position them as shown in the layout, and hold them until the paraffin hardens. Mark the inside of the completed mold at heights of ½, 1, 1¼ and 2 in. above the glass. These are

(Please turn to page 180)

The clean team

Take a typically
dirty carburetor (like
yours maybe) clean
it...and get easier starting,
smoother idling, no stalling, faster
take-offs and better mileage.



1 Clean it outside in seconds with Jet-Spray Gumout. Takes less than a minute to get this! Throat, choke valve, linkage, throttle plate—all clean like new. Grime and gum that can foul up the carburetor's job are gone. Completely.

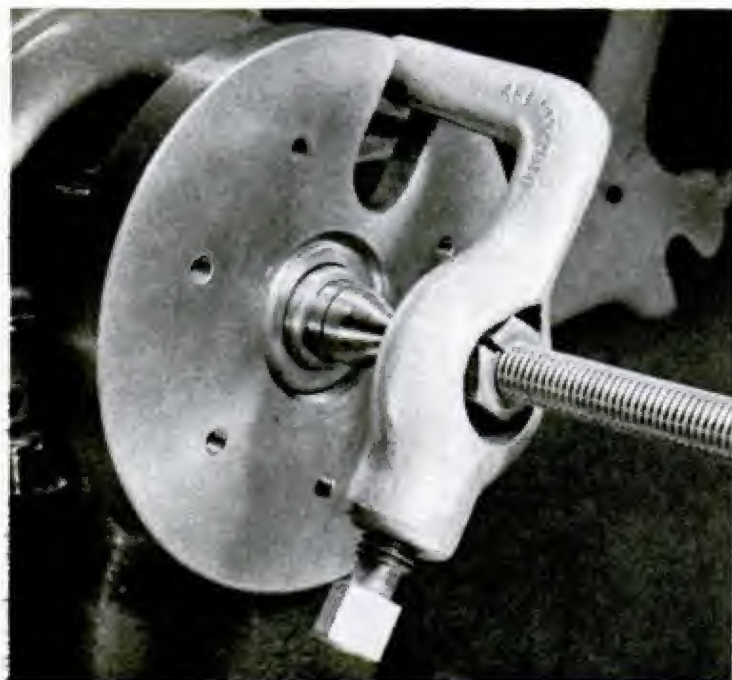


2 Now pour a pint of Gumout in your gas tank. It does the same great job inside your carburetor as you drive. Cleans out all the jets and passages, removes the gum and varnish.

GUMOUT Division
PENNSYLVANIA REFINING COMPANY, Cleveland, Ohio 44104

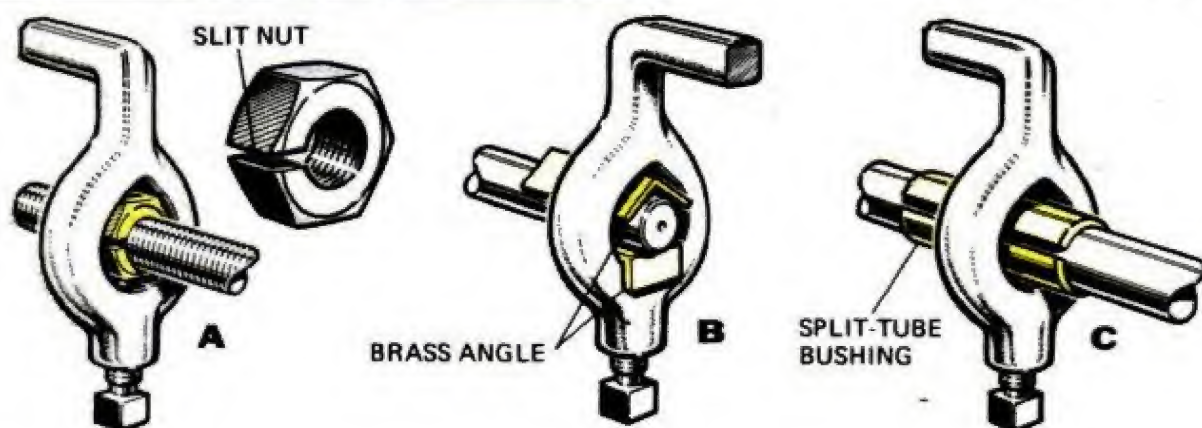
Материал, запатентованный фирмой Гумайт

How to muzzle your lathe dogs



LIKE its canine counterpart, a bent-tail lathe dog often tends to chew on things. If you cinch the setscrew up hard, it usually cuts the workpiece. And if you ease up on tightening, the piece might slip under a heavy cut and get badly scored in the process. I've found that shielding the work with brass pads (as they taught you in shop class) is troublesome to set up, especially on repeat jobs. Instead, I use one of the three homemade fittings shown below and at left. The drawings are self-explanatory and using them you'll be able to teach the old dog a few new tricks and put an end to its bite.

—E. Dussault, Oak Park, Ill.



NEXT MONTH IN SHOP AND CRAFTS

FROM PM'S WORKSHOP: A RADIAL-SAW ACCESSORY CABINET: Designed and built in our shop for *PM* readers to duplicate, this cabinet lets you make use of that valuable, wasted space beneath your radial saw—no matter what make it is. Pick up the March issue and add this "luxury" to your own shop.

WHAT YOU SHOULD KNOW . . . BEFORE TERMITES PUT THE BITE ON YOU. Subterranean termites are hungrily at work in every state but Alaska, and the annual price tag for their appetites is estimated at \$500 million dollars. More important, if you don't know how to spot them, extermination and repairs can cost you from \$500 to \$1000. In next month's *PM*, you'll learn the telltale signs, what you can do as a homeowner and when it's time to call in the pros.

THINGS TO MAKE FOR FUN AND FUNCTION. A collection of quickie weekend projects that includes a doggie bookrack, brain-teasing puzzle, Early American minishelf, "flying" duck weathervane, rotating teeter-totter, salt shakers and a fruit dish.

BUILD PM'S BACK-YARD CARRIAGE HOUSE. It's designed with all the charm of yesteryear, yet it can be put to practical use as a pool cabana, a den (or home office) for Dad, playhouse for the youngsters or for yard and garden equipment storage. Pick up next month's *PM* and build yourself a lawn house that will be the envy of the neighborhood.

Decisions...decisions... I've made my decision-

PALL MALL GOLD 100's
Longer...yet milder



Longer length
...milder taste

Also first class flavor in a filter king
New PALL MALL white



Gold 100's
19 mg. "tar", 1.3 mg. nicotine
av. per cigarette, FTC Report AUG. 71

20 mg. "tar", 1.4 mg. nicotine
av. per cigarette by FTC method.



HINTS FROM READERS

Reducing cardboard thickness

When using cardboard for shims, it is often necessary to slightly reduce its thickness. An easy method I use is to place the cardboard on a sheet of sandpaper and rub it with a sandpaper-covered block of the same grit.—*B. W. Ervin, Kent, Ohio*



Uses for knock-out plugs

Knock-out discs from electrical boxes can frequently be put to emergency use in the home and shop. Four possibilities shown are wheels for toys, washers (after drilling holes), tag for a drill-chuck key and a thumbscrew. For the latter, flatten the disc edge and simply solder the disc in a screw slot.

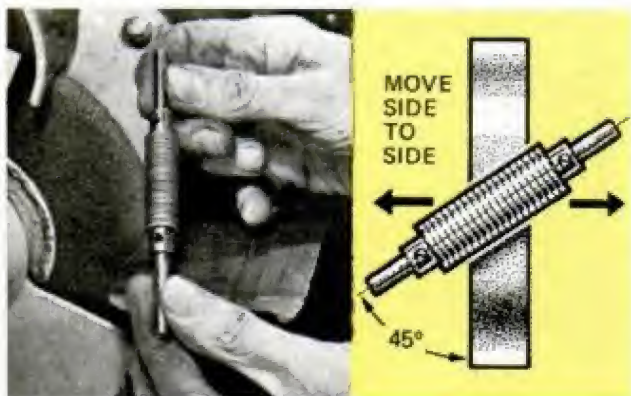
—*W. B. May, Oak Park, Ill.*



Dual-purpose wire brush

An ordinary wire brush is certainly a must in every craftsman's toolbox, but for certain jobs the bristles are too coarse. Rather than buy another tool, I simply glued and screwed a pair of suede leather brushes—the type used for suede shoes—to the back of the wire brush I owned. Result—a dual-purpose, fine/coarse brush.

—*Ken Patterson, Regina, Sask.*



Gang-grinding washers

When you need a lot of same-size washers in a hurry, you can grind an assortment by slipping them on a rod (with a flat ground on one side). Then, with washers held by means of two collars, grinding can proceed. Hold washers at an angle and move them back and forth across the wheel. They will spin as they are ground.—*Frank Rothmann, Anderson, S.C.*



Improvised surface hinge

Recently, when I needed a couple of surface hinges in a hurry on a Sunday, I fashioned my own out of tin-can material as shown. Stock for one leaf is $\frac{1}{2}$ in. wider than the other to allow for right-angle bends. To finish, drill mounting and hinge-pin holes, and use an appropriate-size nail for the "hinge pin."

—*Walter E. Burton, Akron, Ohio*

THE DODGE MAXIVAN STRONG BOX...

Largest compact van built in the United States.

AND VERY BIG IN FEATURES, TOO.

Cargo Area

Largest of any van built in the U.S.

Brakes

New, optional power disc front brakes for improved stopping power.

Floor Space

Greatest load length between engine cover and rear door.

Engines

Largest optional V8 (360 cu.-in.).

Wider Doorway and Step

Easier entrance and exit for driver and passenger.

Independent Front Suspension

Smooth, independent front suspension can be easily aligned on passenger-car equipment, if necessary.

More Legroom

Heater is located under hood instead of under dash to give you ample legroom.

Ease of Loading

Front passenger seat does not intrude into side cargo door entrance. Side doors are widest of any domestic van.

Fuel Capacity

Largest gas tank of any domestic van (26 gallons).

Turning Circle

Tightest turning circle of any domestic van, yet has the longest wheelbase for smoother ride and handling. Easy to park.

Service Repairs

Large hood opening for outside servicing.

Plus More

The Dodge Strong Box has many more fine features which this space does not permit us to list. See your Dodge Truck Dealer. He'll be happy to show them to you.



Dodge Strong Boxes are available in 109-inch-wheelbase, 127-inch-wheelbase, and 127-inch-wheelbase Maxivan versions.

Who gives you toughness that's just your style?

Dodge. Depend on it.





I'd like to give this to my fellow men... while I am still able to help!

I was young once, as you may be—today I am older. Not too old to enjoy the fruits of my work, but older in the sense of being wiser. And once I was poor, desperately poor. Today almost any man can stretch his income to make ends meet. Today, there are few who hunger for bread and shelter. But in my youth I knew the pinch of poverty; the emptiness of hunger; the cold stare of the creditor who would not take excuses for money. Today, all that is past. And behind my city house, my

summer home, my Cadillacs, my winter-long vacations and my sense of independence—behind all the wealth of cash and deep inner satisfaction that I enjoy—there is one simple secret. It is this secret that I would like to impart to you. If you are satisfied with a humdrum life of service to another master, turn this page now—read no more. If you are interested in a fuller life, free from bosses, free from worries, free from fears, read further. This message may be meant for you.

By Victor B. Mason

I am printing my message in a magazine. It may come to the attention of thousands of eyes. But of all those thousands, only a few will have the vision to understand. Many may read; but of a thousand only you may have the intuition, the sensitivity, to understand that what I am writing may be intended for you—may be the tide that shapes your destiny, which, taken at the crest, carries you to levels of independence beyond the dreams of avarice.

Don't misunderstand me. There is no mysticism in this. I am not speaking of occult things, of innumerable laws of nature that will sweep you to success without effort on your part. That sort of talk is *rubbish*! And anyone who tries to tell you that you can *think* your way to riches without effort is a false friend. I am too much of a realist for that. And I hope you are.

I hope you are the kind of man—if you have read this far—who knows that anything worthwhile has to be *earned*! I hope you have learned that there is no reward without effort. If you have learned this, then you may be ready to take the next step in the development of your karma—you may be ready to learn and use the secret I have to impart.

I Have All The Money I Need

In my own life I have gone beyond the need of money. I have it. I have gone beyond the need of gain. I have two businesses that pay me an income well above any amount I have need for. And, in addition, I have the satisfaction—the deep satisfaction—of knowing that I have put more than three hundred other men in businesses of their own. Since I have no need for money, the greatest satisfaction I get from life is sharing my secret of personal independence with others—seeing them achieve the same heights of happiness that have come into my own life.

Please don't misunderstand this statement. I am not a philanthropist. I believe that charity is something that no proud man will accept. I have never seen a man who was worth his salt who would accept something for nothing. I have never met a highly successful man whom the world respected who did not sacrifice something to

gain his position. And, unless you are willing to make at least half the effort, I'm not interested in giving you a "leg up" to the achievement of your goal. Frankly, I'm going to charge you something for the secret I give you. Not a lot—but enough to make me believe that you are a little above the fellows who merely "wish" for success and are not willing to sacrifice something to get it.

A Fascinating and Peculiar Business

I have a business that is peculiar—one of my businesses. The unusual thing about it is that it is needed in every little community throughout this country. But it is a business that will never be invaded by the "big fellows." It has to be handled on a local basis. No giant octopus can ever gobble up the whole thing. No big combine is ever going to destroy it. It is essentially a "one man" business that can be operated without outside help. It is a business that is good summer and winter. It is a business that is growing each year. And, it is a business that can be started on an investment so small that it is within the reach of anyone who has a television set. But it has nothing to do with television.

This business has another peculiarity. It can be started at home in spare time. No risk to present job. No risk to present income. And no need to let anyone else know you are "on your own." It can be run as a spare time business for extra money. Or, as it grows to the point where it is paying more than your present salary, it can be expanded into a full time business—overnight. It can give you a sense of personal independence that will free you forever from the fear of lay-off, loss of job, depressions, or economic reverses.

Are You Mechanically Inclined?

While the operation of this business is partly automatic, it won't run itself. If you are to use it as a stepping stone to independence, you must be able to work with your hands, use such tools as hammer and screw driver, and enjoy getting into a pair of blue jeans and rolling up your sleeves. But two hours a day of manual work will keep your "factory" running 24 hours turning out a product that has a steady and

ready sale in every community. A half dollar spent for raw materials can bring you six dollars in cash—six times a day.

In this message I'm not going to try to tell you the entire story. There is not enough space on this page. And, I am not going to ask you to spend a penny now to learn the secret. I'll send you all the information, free. If you are interested in becoming independent, in becoming your own boss, in knowing the sweet fruits of success as I know them, send me your name. That's all. Just your name. I won't ask you for a penny. I'll send you all the information about one of the most fascinating businesses you can imagine. With these facts, you will make your own investigation. You will check up on conditions in your neighborhood. You will weigh and analyze the whole proposition. Then, and then only, if you decide to take the next step, I'll allow you to invest \$15.00. And even then, if you decide that your fifteen dollars has been badly invested I'll return it to you. Don't hesitate to send your name. I have no salesmen. I will merely write you a long letter and send you complete facts about the business I have found to be so successful. After that, you make the decisions.

Does Happiness Hang on Your Decision?

Don't put this off. It may be a coincidence that you are reading these words right now. Or, it may be a matter that is more deeply connected with your destiny than either of us can say. There is only one thing certain: If you have read this far you are interested in the kind of independence I enjoy. And if that is true, then you must take the next step. No coupon on this advertisement. If you don't think enough of your future happiness and prosperity to write your name on a postcard and mail it to me, forget the whole thing. But if you think there is a destiny that shapes men's lives, send your name now. What I send you may convince you of the truth of this proverb. And what I send you will not cost a penny, now or at any other time.

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Who'd have thought I'd make so much money without going to college?



I still have to pinch myself every week when I open my pay envelope—it seems too good to be true!

Especially when I remember how sorry everyone felt for me because I couldn't go on to college with the others in my high school class. "How are you ever going to make it now?" people kept asking me. "Without college, it's a losing battle. Everybody knows that!"

Well, the college boys left for school, and I got my first job. And it was tough going for a while, I'll admit that—one dull, routine thing after another. From pumping gas to driving a cab to working on an assembly line in a factory. I worked hard but never "struck it big."

Then I read an announcement like this one about the opportunities in Electronics.

I discovered that, with proper training, I could have my pick of thousands of glamour jobs—in fields like radio and TV broadcasting, automation, computer servicing, or even the aerospace program.

And I found out that as you move up the ladder in this booming field of Electronics, you can earn the kind of money that even a college man could be proud of—up to \$5, \$6, \$7 an hour...\$200, \$250 a week...\$10,000, \$11,000, even \$12,000 a year!

And—most important—I realized how easy it would be to get the training I needed to break into this great field. The announcement said I could learn everything I needed to know, right at home in my spare time, with a home study course from the Cleveland Institute of Electronics.

Well, to make a long story short, I enrolled with CIE. I found that their courses had taken what seemed like a complicated subject and broken it down into easy steps. Sympathetic instructors sent me letters helping me over the rough spots. I really learned fast. And here I am now, a respected Electronics man—earning so much money I still have to pinch myself.

Thanks to CIE, I don't have to envy the college boys anymore. In fact, there are some that envy me!

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PM-62



KING-SIZE BENCHES flanking a Delta radial saw provide an ideal support for extra-long workpieces. Construction includes fence equipped with "built-in" tape measure for speedy and accurate setting of the stops

This radial-saw bench features

The stops give measurement readings quickly and can be relocated with the twist of a knob

By **HARRY L. COLLINS**



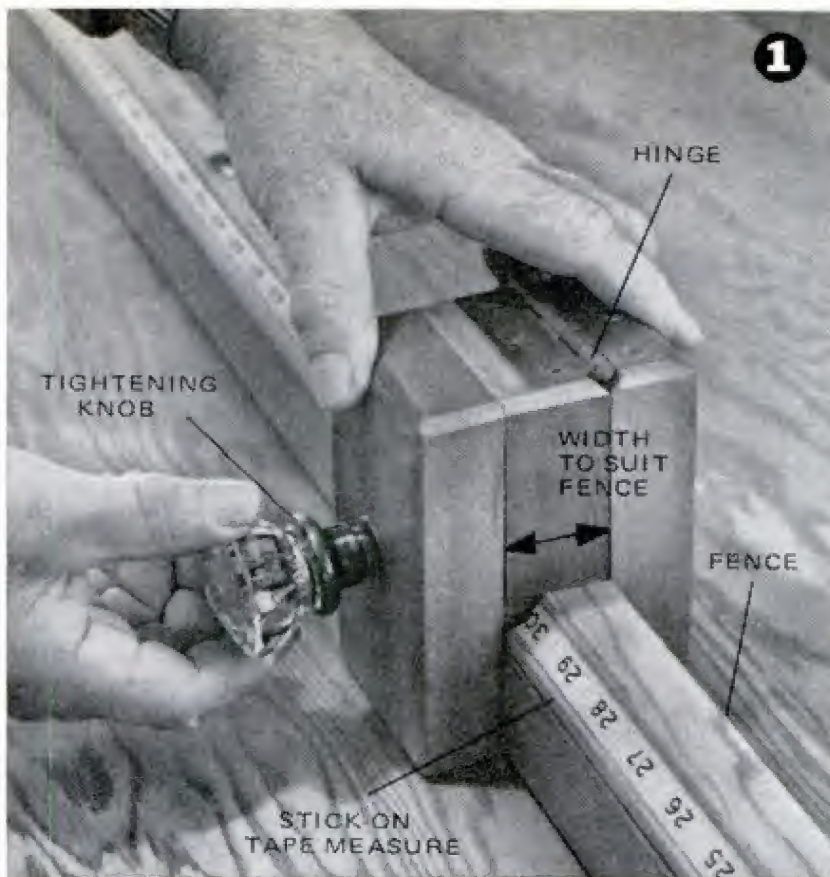
SHORT LENGTHS, as well as long, are easily handled by author's setup. Benches are built using basic construction techniques, could be fitted with drawers

THE VERSATILE and time-saving radial-arm saw can be even more versatile if a couple of sturdy benches, adjustable table fences with gauge rails and stop clamps are set up flanking the rig.

The tables shown can be used with any radial saw, the only limitations being saw-table height and length of the wall against which it stands. The setup shown is built around a Delta-Rockwell saw positioned against a 15-ft.-long wall. Thus, I was able to build two 6-ft. tables, one for each side of the saw.

Construction techniques are basic. After deciding height and length of your tables, build a framework of 2x3s or 2x4s and skin the top surface with 3/4-in. plywood. For added rigidity, install a 6-in.-wide apron across the front (just below the worktop). Tables, of course, should be level when placed next to the saw, and

POPULAR MECHANICS



1

1. ADJUSTABLE STOP-CLAMP is an improvement on the hinged fixed-position type found in lumberyards (which are usually spaced at 1-ft. intervals). Here the stop is being set at exactly $30\frac{1}{4}$ in. Clamping "knobs" used by author are glass doorknobs salvaged from old door. For safety, stops should be sturdily constructed of hardwood and joined with flathead screws, glue

2. RADIAL-SAW SETUP has benches that support workpieces whether they are cut right or left-handed. Benches are built using standard 2x3-frame construction, and then skinned with plywood. Lengths of benches are limited only by the wall space available in your shop

3. TO BRIDGE GAP between end of fence and saw blade when you make short cutoffs, a 20-in. gauge strip must be used. If you want to cut several 10-in. pieces from a long board, for example, the stop is clamped at 30 in. and the strip brought into use for workpiece to butt against. Strip can be drilled and hung in a convenient location

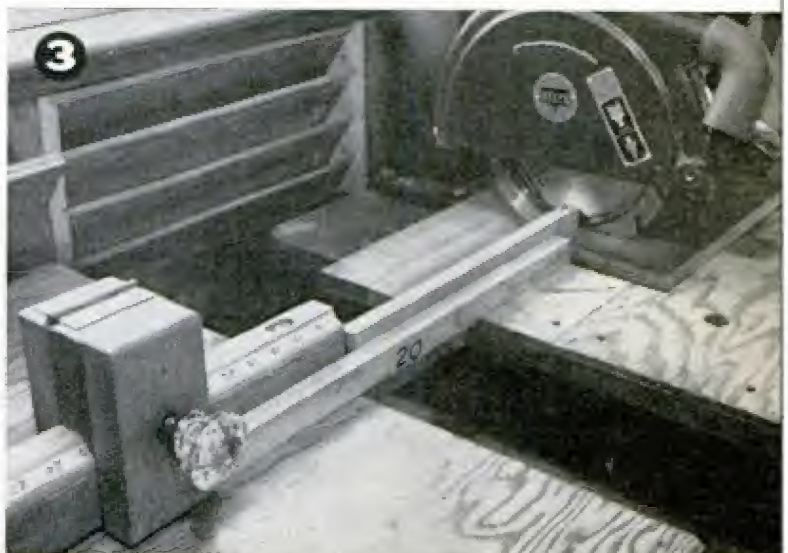
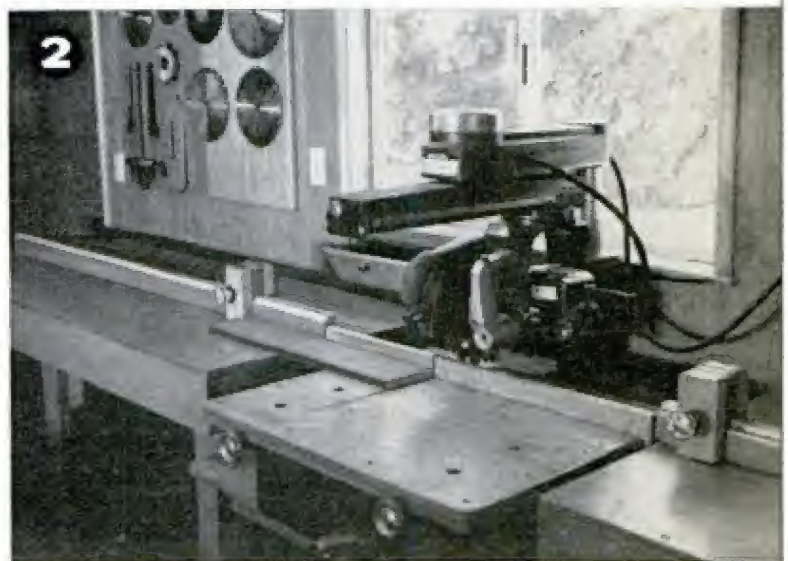
built-in stops

at least 1-in. clearance should be allowed between the benchtops and the radial-saw top.

The gauge stop-clamps should be made from hardwood. One stop-clamp is required for the fence on each bench and (as can be seen in the photo above) each is made up of three pieces of wood and a butt hinge. The clamp dimensions will be determined by the height and thickness of your fence.

Doorknobs shown have $\frac{3}{8}$ -16 internal threads (standard on most doorknobs). Knobs are held on the clamp with a $\frac{3}{8}$ -16 x $4\frac{1}{2}$ -in. carriage bolt inserted from rear to front. For a good hold, use a flat washer beneath each bolt head.

Although I used a standard tape set into routed-out recesses, the new self-stick type could be used. Just make certain that measurements are accurate when you position the tapes and that they are installed after the benches have been fixed in one position so that any movement is impossible. ★★★





HINTS FROM READERS

Stopping belt-clamp slippage

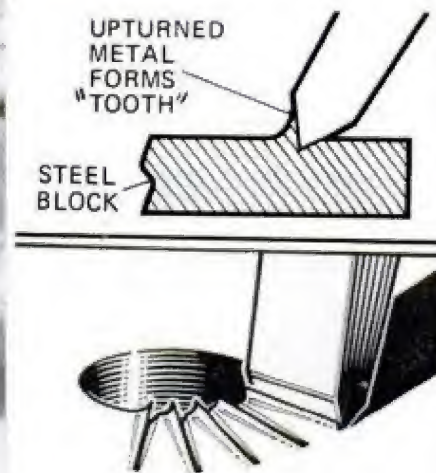
It's not unusual—and it can be pretty frustrating—to have a belt-clamp slip after you have all parts glued and aligned. Though this clamp is ideal for such repair jobs as wobbly legs on a chair, it does tend to slip due to leg taper. You can stop this from happening by looping one end of the clamp around a chair rung as shown. The stunt works for me every time I use it. —Robert Brightman, Great Neck, N.Y.



Totable anchor takes no space

Because the slightest current or breeze will cause our rubber boat to drift when we want to fish a particularly good spot, an anchor is a necessity. Shown at left is the simple one that we use. It consists of an old fishing bag filled with rocks found at the fishing site and a length of sturdy rope. When you're through for the day, simply dump out the rocks and store the fishing bag for your next outing. To make certain that it's always at hand, keep the fishbag inside of the deflated and folded boat.

—John Krill, North Lima, Ohio



Scrap-steel 'tool' provides easy method for cutting tenons

A scrap steel block can be converted in minutes into a "tool" for forming tenons on the ends of wood dowels and rungs. A hole with the diameter of the desired tenon is drilled through the block. Then, a sharp cold chisel is used to form a series of cutting edges around the hole on the block surface. The resulting teeth resemble

those on a rasp and are positioned so they cut when the dowel is rotated clockwise against them. After tapering the tip of the dowel, you can chuck it in a drill press or hand brace-and-bit to do the cutting. When the teeth wear out, simply flop the block and use the other side.

—Walter E. Burton, Akron, Ohio

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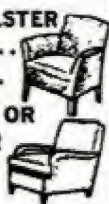


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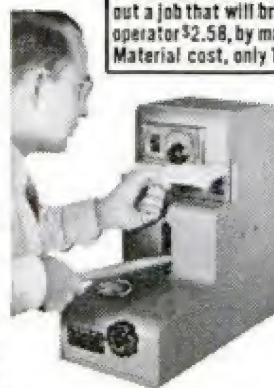
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DUCT THROUGH HOUSE WALL (above, left) is capped outside with butterfly damper attached with screws

KIT OF PARTS (left) includes two rings, two caps, flexible duct, damper, power cord and fittings, plus a 240-v. receptacle. Price of kit is \$23 postpaid



EXHAUST PORT in outside wall is located 12 in. from floor. The 240-v. receptacle is shown adjacent

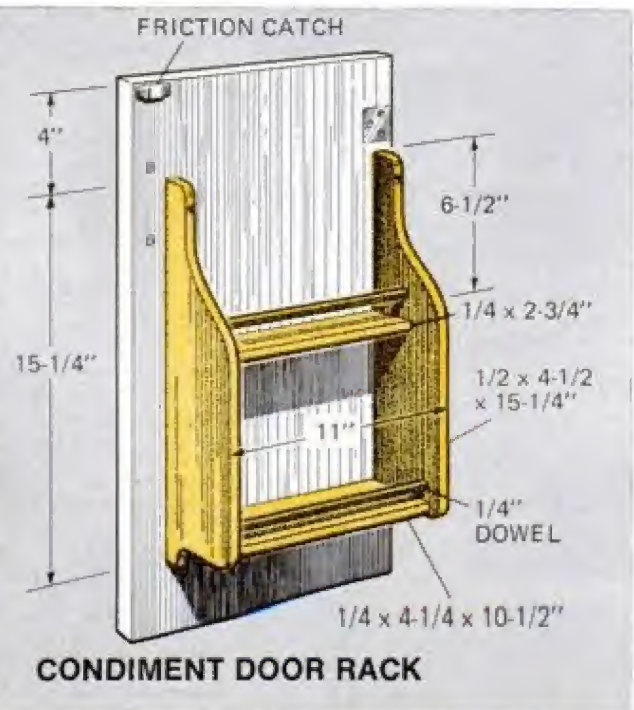
COOK WHERE THE FUN IS

(Continued from page 137)

spring-loaded friction catches placed at the ends of the aprons hold them in an upright position.

The electric grill sits in the hole provided and is secured in place with locking screws. Two standard 5-in. elbows and a straight section of galvanized smoke pipe are needed to duct the ventilating fan through the hole in the side of the cabinet. An aluminum ring that comes with the kit fits the hole on the outside. The outdoor exhaust port is installed by cutting a 5-in. hole through the wall and inserting a 5-in. section of 5-in. galvanized pipe. The pipe is then fitted with a ring on the inside and a damper on the outside. ★★★

HANDY CONDIMENT RACK is attached to left-hand door. Details (below) show how the rack is assembled



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CHOOSING A MARINE COMPASS

(Continued from page 92)

compass. You can often eliminate error by relocating the compass. If this isn't practical, small external magnets can be mounted about the compass to correct deviation.

- If you do any nighttime sailing, a built-in compass light is far more convenient to use than a flashlight. Be sure that the light is protected since salt spray and weather can cause corrosion and failure. Daytime sailors can save themselves a couple of dollars by omitting the light.

- If you own a small boat, easy removal of the compass may be a consideration to protect it from theft and vandalism. Check the demounting procedure to be sure it isn't complicated.

- Compass mounts. Some compasses require mounting to a horizontal, flat sur-

U-shaped bracket allows compass to be mounted horizontally or vertically

face, but some boats don't have this readily available. Consider the surfaces in your boat on which you can mount a compass. A compass having a U-shaped bracket may be needed. This allows the compass to be mounted on a horizontal or vertical surface, or side-mounted or front-mounted at any angle.

Other compasses can be surface-mounted on the dashboard, installed in the dashboard or mounted on the deck.

The best advice anyone can offer about mounting a compass is to follow the manufacturer's instruction book, which should accompany the instrument. Compass companies spend money and time on research to find out under what conditions their instruments will work best.

- If the mounting location is exposed to the weather and salt spray, the compass binnacle should be finished with baked enamel paint or be made of plastic. Chrome and polished brass require a great deal of attention to retain their appearance and are impractical in exposed locations.

Most instruments come with complete instructions regarding care and maintenance. Follow these closely for best results. If you've misplaced these instructions or happen to have an older compass,

the following suggestions will be helpful:

When laying up the boat for the winter, try to remove the compass from its mounting on a day of moderate temperature. This will prevent unnecessary strain on gaskets.

Check the compass on occasion for bubbles and a broken pivot or jewel. A marine compass card is almost invariably enclosed in a liquid-filled chamber. The liquid dampens the movement of the card—that is, it acts as a shock absorber and slows down the action of the card so that in rough water the card won't rock excessively or hunt back and forth.

When a bubble forms—you'll see it—it doesn't indicate any inaccuracy although it may cause some distortion in readings. The cause is either low temperature or worn gaskets.

Allow the compass to wait for a warmer day to see if the bubble disappears. If not, send it to the manufacturer or take it to a competent instrument repair shop for replacement of gaskets. Do-it-yourself compass repair is not recommended.

The condition of the pivot and jewel can be established by placing the compass on a level surface away from magnetic objects. Allow the card to come to rest on a degree mark.

When the card is no longer moving, bring a jackknife or screwdriver close enough to pull the card off the reading by about 10°. Remove the disturbance and check to see if the card returns to its original position. If not, consult a repair company.

As for using a marine compass, there are several excellent sources you can consult. Most can be found in a library. The following are widely recognized:

1. *Piloting, Seamanship and Small Boat Handling* by Chapman—published by *Motor Boating and Sailing Magazine*.

2. *American Practical Navigator* by Bowditch—published by the U. S. Navy Hydrographic Office.

3. *Navigation and Piloting* by Dutton—published by the U. S. Naval Institute.

4. *Handbook of Magnetic Compass Adjustment* by Spencer—published by U. S. Navy Hydrographic Office.

Some manufacturers you might want to write about their marine compasses:

Airguide Instrument Co., 2210 Wabansia Ave., Chicago, Ill. 60647.

Aqua Meter Instrument Corp., 465 Eagle Rock Ave., Roseland, N.J. 07068.

Danforth White, 500 Riverside Industrial Parkway, Portland, Me. 04103.

E. S. Ritchie & Sons, Inc., Pembroke, Mass. 02359.

Hull Manufacturing Co., Logan and High, N.E., Warren, Ohio 44481.

OMNI Laboratories, Inc., 31 Green St., Marblehead, Mass. 01947.

Sherrill Corp., River Ave., Mexico, Ind. 46958. ★ ★ ★

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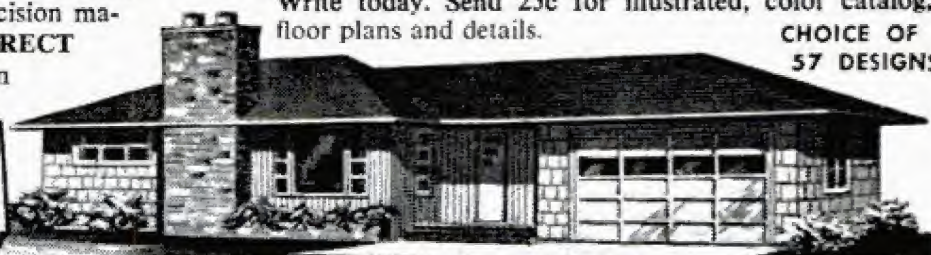
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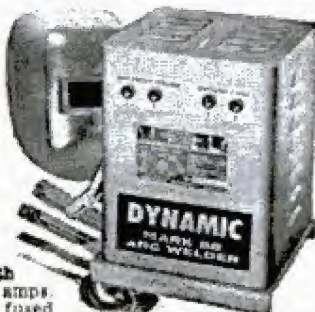
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BIG BANGER FROM SUZUKI

(Continued from page 133)

no "off" position on the fuel valve, with fuel being turned on and off automatically with a diaphragm working off intake vacuum.

Starting, hot or cold, was always practically instantaneous. The choke lever is conveniently located near your left thumb on the handlebar, a commendable improvement over the down-under types. The instrument cluster, consisting of a 160-mph speedometer with odometer and trip indicator, a 9000-rpm tachometer, and a coolant temperature gauge, is legible, well lighted and noticeably vibrated only at or near idle. The coolant is a special brew of antifreeze, water and other chemicals to protect the aluminum engine. The gauge has no numbers, but two tiny dots indicate temperature at which the thermostat opens and where the fan comes on.

Except for water jackets in the cylinder head and cylinder block and the gear and shaft-driven water pump set deep in the lower half of the case, the general engine layout is not remarkably different from other three-cylinder two-strokes. The electric starter nestles between the engine and gearbox sections, and a conventional ignition setup works off one end of the crankshaft and an alternator off the other. A lot of the tinkling noise we hear from air-cooled two-strokes comes from the fins resonating. The water jacket dampens and eliminates mechanical noise from this engine, and the decorative fins on the head, block and crankcase are too short and stubby to resonate.

A final surprise came on looking into gas mileage. At highway speed it gets close to 40 miles out of every gallon of economical regular gasoline, a far cry from what we've learned to expect from gas-guzzling air-cooled two-stroke superbikes. With them, you are lucky to go 100 miles before fuel, including reserve, is depleted. With the Suzuki water-cooled, you can go 160 miles and still have 20 miles to find a gas station on reserve. The convenience of this outstrips even the economy for long-distance touring where service stations are few and far between.

It also becomes apparent why higher performing air-cooled two-strokes get such poor gas mileage. They are made to run very rich to aid in cooling, permitting higher power output than otherwise possible without damage. This is a standard procedure for air-cooled aircraft piston engines, where the mixture control is set to "rich" at higher power settings to aid in engine cooling. But they are throttled back and leaned out at every opportunity,

or else fuel consumption becomes atrocious.

The most negative reaction from bike people who've seen the new bike concerns styling. Practically to a man, those commenting didn't like the looks, but all agreed that water cooling is a good idea. One summed up the mixed feelings when he said, "I'd probably get one anyway. At least I wouldn't have to look at it while I'm riding it." It may take a model change or two before stylists learn what to do with skinny engines, half hidden by a black slab of radiator, that will please eyes accustomed to finny, sculptured, air-cooled engines fully exposed to view.

It's easy to forget that water-cooled motorcycles are not new. In fact, the earliest ones were water-cooled. The simplicity of air cooling won out because metallurgical and other limitations restricted power outputs, making liquid cooling not an absolute necessity. But now, with the demand for lots of power without sacrificing economy or adding much to weight or purchase price, the time seems ripe for water-cooled two-strokes. For this reason it's likely that the Suzuki will catch on where the Scott and its predecessors did not. ★★ ★

FIAT 124 OWNERS REPORT

(Continued from page 75)

winds don't affect stability, nor does the backwash from big trucks. More power, particularly for passing, was the main wish from this same group. All Fiat drivers rate workmanship and overall quality generally superior to U.S. cars and several other imports.

On the minus side: "Pedals too close together." "I don't like the dimmer switch on the steering column; sometimes I turn the lights off accidentally at night when my hand bumps the switch." "Engine noisy at 60 mph." "Torque converter whines at 60 mph." "Engine is cold natured, too slow to warm up."

"I think they should improve the quality of the radio—the Japanese make much better ones." "I like the standard equipment: reclining bucket seats, carpeting, lights under the hood and trunk."

Most owners of the sport versions were attracted initially by the Spider's and Sport Coupe's looks—sporty appearance. For owners of the Fiat 124 sedan and wagon, the initial appeal was economy. But owners found that driving could be fun again. As one respondent put it: "My main reason for buying the Fiat was economy. But after I drove one, economy didn't matter anymore!" ★★ ★

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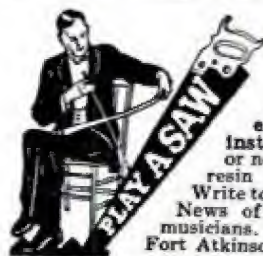
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FOUR-WAY WELDER CO., 1810 Federal St., Dept. PM22, Chicago, Ill. 60616

A LITTLE COLONIAL CHARMER

(Continued from page 141)

is shorter than the overall length of the cabinet. Cut the top edge as indicated, round the edges as before and glue in place.

The drawers ride on rails installed along each side of the openings. They are cut on the table saw from 2x4 stock and rest on a cleat glued and nailed to the cabinet back. The outer rails are glued and screwed to the cabinet sides. The center rails (actually two rails in one) are glued at the front and nailed to the cleat at the back. Notice that the rails project $\frac{1}{16}$ in. into the opening on each side. Follow typical drawer construction when you make the drawers and take dimensions directly from the cabinet. The drawer fronts are rabbeted all around so they will lap the openings.

Unless you happen to have a shaper and a set of regular sash cutters, it will be almost impossible for you to duplicate a factory-made raised-panel door in which the panel sits in a groove and the molded, mortised members are undercut to fit perfectly at the corners. The best a home craftsman can do is to assemble simple frames of $\frac{3}{4}$ -in. stock, butt-glue the joints and use a portable router to run the rabbet on the back for the panel and to shape the molded edge on the front. The overall effect is practically the same and few will notice any change. The main difference is that the cutter will leave a rounded inside corner instead of a square one.

Another way to make the doors is to run the stock like picture-frame molding and simply miter the corners. However, this makes a somewhat less authentic-looking door.

The raised panel is a simple thing to run on your table saw by tilting the blade and passing the work through on edge. Then the shallow shoulder cut is made with the work flat on the table and against the fence. A $\frac{1}{8} \times \frac{3}{4}$ -in. flat molding holds the panel in the frame and covers the joint. As with the drawers, the doors are rabbeted all around so they will lap the openings.

Appropriate hand-wrought hinges should be picked for the doors. You'll need the kind which are offset to accommodate the door lip. White porcelain knobs carry out the colonial feeling.

If you plan to use live potted plants in the sink which require watering and tending, you should fit the top with a shallow sheet-metal tray. A lift-out copper lining could also be considered.

To finish your dry sink, first sand the wood until you are satisfied with its smoothness. You can start with a medium

grit and finish with a fine-grit paper. (If you prefer an early American "primitive" look, don't oversand the wood.) After the sanding has been completed, wipe off all sawdust.

For a natural or stained finish apply the color stain you prefer, following directions on the can label. Allow to set for approximately 15 to 20 minutes and then—using a clean rag—wipe off all excess, rubbing with the grain. Allow the piece to dry overnight (24 hours). If desired, the piece can be antiqued by blending in burnt umber with a rag. (This, too, must be allowed to dry for 24 to 48 hours.) To finish, apply two coats of McCloskey Heirloom semigloss varnish. Allow 24 hours drying time between coats. After approximately three weeks, rub lightly with double-O steel wool saturated with Butcher's Wax and buff to a sheen.

Antiquing hints: Use burnt umber—direct from the tube—to simulate any surfaces that will be exposed to the most dirt accumulation over a long period of time (in corners or crevices, for example). And always blend the burnt umber into the mating stain so that there is no visible "line" or joint. ★★★

'G-METER' FOR YOUR DASH

(Continued from page 158)

the limits of the successive resin pours.

First pour. Clear Cast or its equivalent (but not the surface coating resin) is cast in the mold to make the meter body. Mix 5 oz. resin and 10 drops catalyst and pour to the $\frac{1}{2}$ -in. mark. Be sure no bubbles are trapped between the balsa and the sides of the mold. This is a slow-curing mix and it should be allowed to set for several days.

All the remaining pours will cure in a few hours and one may follow the other as soon as the heat of the chemical reaction has dissipated.

Next, mix 5 oz. resin and 20 drops catalyst and pour to the 1-in. mark, then mix 3 oz. resin and 15 drops catalyst. Pour just enough to fill the shrinkage space around the previous pours. Then add 5 drops red dye and pour to the $1\frac{1}{4}$ in. mark. While this is setting, find a clear plastic box (like those used for small hardware and jewelry) about 1 x 3 in. and $\frac{1}{2}$ in. deep (with the lid off). Discard the lid and grind away the hinges and latch.

Mix 1 oz. resin, 4 drops catalyst and 1 drop red dye. Pour only a thin coating. Position the plastic box, open side down, over the protruding straws. Bed the box well in the fresh resin and weight it to keep it centered until the resin sets. Fi-

nally, mix 7 oz. resin, 28 drops catalyst and 10 drops red dye. Pour to the 2-in. mark and let the mold set for several days.

Remove the mold sides. Remove the glass by twisting, pick out the balsa with a sharp tool and pull out the straws with needle-nose pliers. The meter face will be curved due to shrinkage so sand it flat with a coarse sandpaper. Two blocks of hardwood clamped to opposite sides of the meter body (see photo on page 157) will limit the depth of cut and prevent rounding the edges.

Covering face of the meter

Cut $\frac{5}{16}$ -in.-wide strips of thin clear-plastic sheet to barely cover the channels in the face of the meter. If a clear sheet of 4x5-in. photographic film is used, the strips can be cut without joints where the channels turn.

Don't try to cover the meter face with a sheet of plastic; this invites leakage between systems. Cement the strips down with surface coating resin (not Clear Cast). When hard, paint several layers of surface coating resin over the entire meter face. Drill small filler holes from the top of the meter body into each of the two systems of fluid passages.

Applying the scales

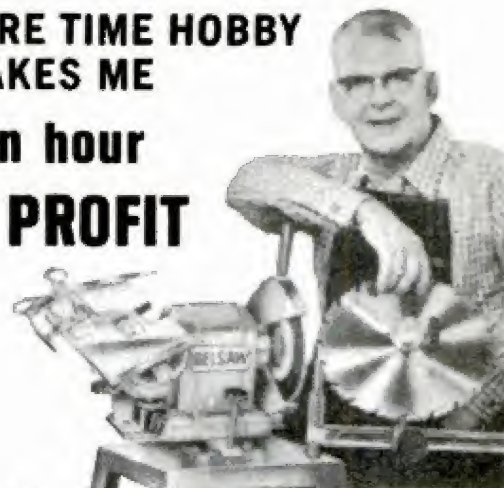
You can roughen the meter face, draw the scales and then restore the shine with another coat of resin. Or you can cut out the illustrated scales and paste them on. The neatest approach is to have a litho service reproduce the scales on film to attain backlighted lettering.

You can make a decorative bezel or a glare hood for the meter. Holes can be drilled and tapped in the body for mounting brackets and if the meter is mounted in a dash panel, it will have to be back-lighted.

With the meter mounted in the car—and the car level—fill the passages with green ethylene glycol antifreeze (without a stop-leak additive) using a precision oiler. Fill just to the zero marks of each set of scales. Ethylene glycol has the right viscosity to respond quickly but will not slosh about and it won't attack the plastic unless water is added.

After you've built the G-meter, make some full-throttle acceleration runs within safe and legal bounds. Have a passenger record G readings at various speeds for future comparisons. Get an idea of braking Gs. They'll be at least twice as high as acceleration Gs because all four wheels are acting. Again, don't try to measure lateral G capability. The lateral scales are just for fun.—John P. Reid

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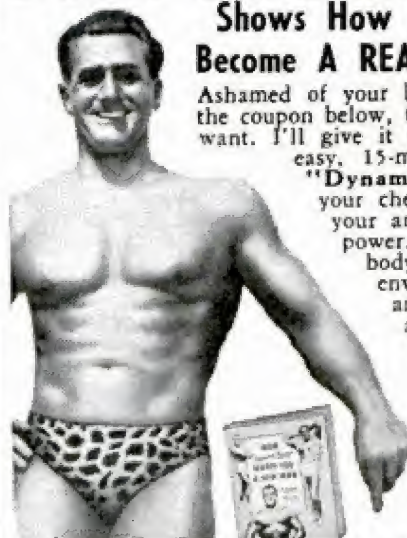
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WELL-TRAINED DOG

(Continued from page 87)

of the leash—wait a moment—then say the dog's name and the command *come*, at the same time giving a gentle tug on the leash. When the dog responds properly from this position, he may be put on a long leash—a 50-foot clothesline is good—and permitted to wander around. Then he is called by his name and ordered to come.

Dog owners in a group class are always urged to work their pet daily for at least 15 to 20 minutes on a leash. Without day-after-day practice, dogs forget what they've learned. Continual work with the dog in all phases of his training will reinforce his responses until he is considered to be reliable enough to work without a leash.

Owners should also work a dog off-leash in an enclosed area until sure their pet will not run away. And they should always run their pet through the entire command routine before removing the leash.

Even a well-trained older dog should be run through the command series occasionally on a leash to keep his responses from getting sloppy.

But even well-trained dogs can get out-of-hand at times. Overly friendly dogs often jump up on people to show their enthusiasm. This can be easily handled. When the dog jumps up, place your knee firmly against his chest and shove him backwards, saying *no* at the same time. Stepping on the dog's hind toes is equally effective.

Excessive barking can also be controlled, especially if discipline is begun early, by holding the dog's mouth closed and firmly saying *no*. A dog must bark sufficiently to warn of an intruder, but he should obey his owner's command to be quiet once the alarm is sounded.

If your dog doesn't show enough protective qualities, there are ways a professional trainer can rouse this instinct. But experts caution that this should not be done by the dog owner because he may end up with an overly protective pet who could be dangerous.

Aging dogs can be trained as well as young ones, but it's more difficult. Often, a professional trainer has to be called in to make the older pet socially acceptable, but there is no guarantee this will work unless an owner changes his own permissive personality.

The behavior of a dog often reflects the personality and attitudes of his owner. The choice between a pet and a pest is largely up to you.

★★★

MAKE THIS SHAPER FOR \$60

(Continued from page 154)

necessary to allow the belt to ride on the flat pulley). Make the electrical connections as shown. This includes an easy way to reverse the motor, using an inexpensive double-throw, double-pole toggle switch. A reversing motor is a "must" on a wood shaper, and this method will cost only a dollar or so to bring it off. A store-bought one costs about \$8. After making all electrical connections, put a cutter on the spindle and turn the machine by hand to make certain everything works freely and nothing hits or drags anywhere. (Caution: While doing this, make certain the shaper is not plugged into a power source). Next, mount the belt guard and turn on the machine.

The shaper should run fairly quietly, with very little vibration. For accurate cutter-height adjustment, I recommend buying a good set of 1/2-in. bore shaper collars and using them to set the cutter at approximately the height you need. Then, use the height adjustment on the machine for final, precise changes.

Though it runs quietly, don't let the lack of noise lull you into carelessness. The shaper is a potentially dangerous tool and should be accorded all the caution and respect you would give a saw, jointer, router or other power tool. When operating it, keep your hands and fingers out of line with the spindle. Then, if you make a slip or hit a knot, your fingers won't go into the cutter. ★★★

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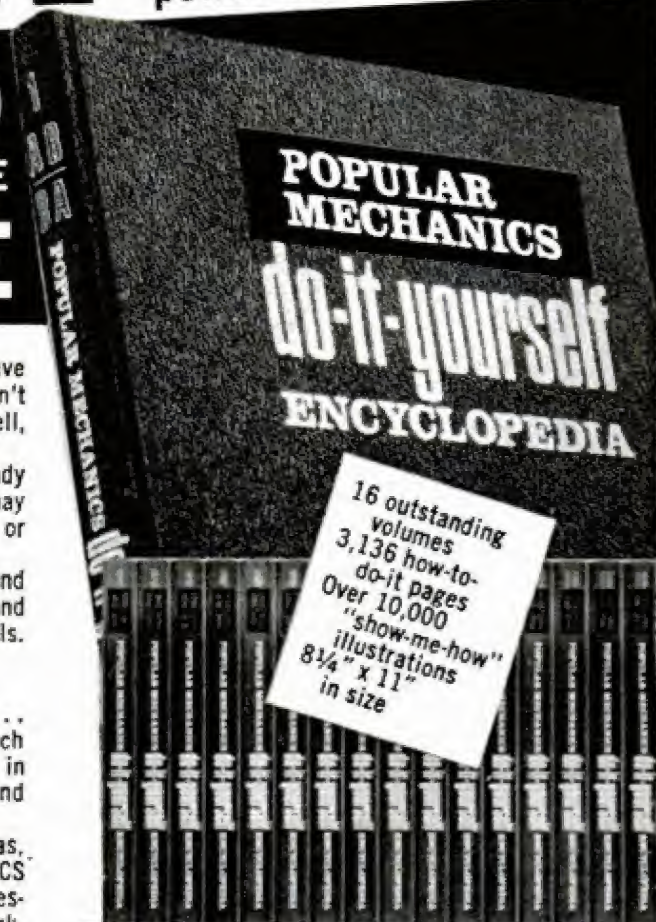
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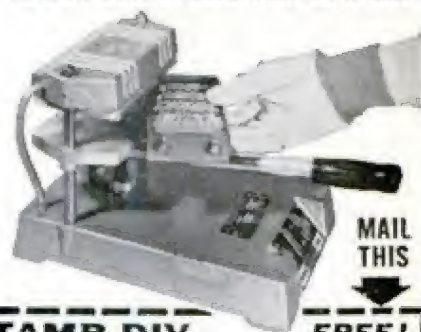
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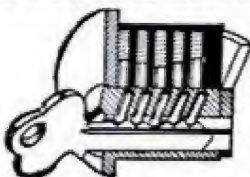
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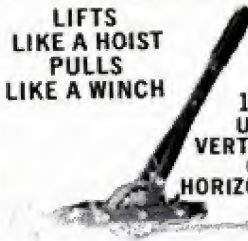
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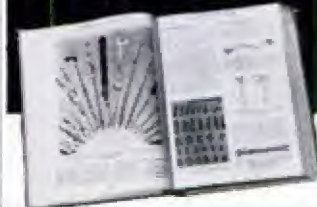
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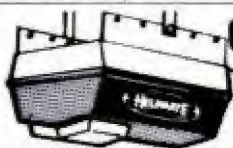
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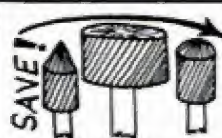
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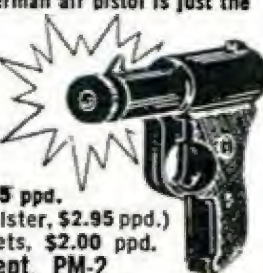
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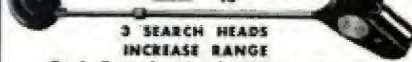
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SECRETS! Mail Order Success. Internationally famous expert reveals how to make home business fortunes. Beginners: Get free copy "Make Money By Mail." Discloses free advertising, profitable products. Mailco, Dept. F2702, Woodland Hills, California 91364.

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MAILERS Needed! Big money! Send 10¢ for information. Andrew Sales, Box 152, Blue Island, Ill. 60406.

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(Continued on next page)

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(Continued from preceding page)

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(Continued from preceding page)

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(Continued on next page)

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(Continued from preceding page)

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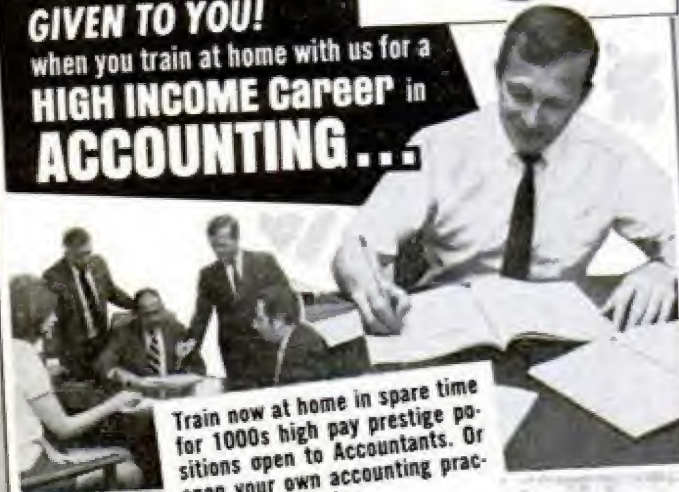
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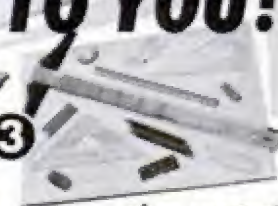
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